Technology Review \$3.00

THE HIDDEN NUCLEAR LEGACY

IMAGINE A LAKE THE SIZE OF MANHATTAN 40 FEET DEEP.

THE U.S. GOVERNMENT HAS DUMPED THAT MUCH RADIOACTIVE WASTE DIRECTLY INTO THE SOIL.

AND THAT'S JUST THE BEGINNING...



technology review

Published by MIT

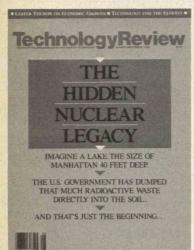
This PDF is for your personal, non-commercial use only.

Distribution and use of this material are governed by copyright law.

For non-personal use, or to order multiple copies please email permissions@technologyreview.com.

INDULGENT. THE SENSE OF REMY. REMY MARTIN Rémy Martin COGNAC I TANCE FINE CHAMPAGNE COGNAC

TechnologyReview



42 RADIOACTIVE WASTE



26 EUREKA



WHY SENIORS DON'T USE TECHNOLOGY



34 WHY SENIORS

26 EUREKA!

BY DAVID DICKSON

An innovative program in Europe aims to stimulate cooperative R&D and bring new technologies to market.

34 WHY SENIORS DON'T USE TECHNOLOGY

BY FRANK BOWE

Products on the market could ease the burdens of age, but they are not sold in ways that appeal to seniors.

42 RADIOACTIVE WASTE: HIDDEN LEGACY OF THE ARMS RACE

BY ROBERT ALVAREZ AND ARJUN MAKHIJANI

The military has dumped vast quantities of radioactive waste into soil and groundwater, threatening nearby communities.

52 THE STAGE SHIFTS IN ARMS CONTROL

BY LEON V. SIGAL AND JACK MENDELSCHN

The Soviets may soon propose substantial cuts in conventional weapons. NATO should be ready to deal.

62 PROFILE: PHILIP JOHNSON, ARCHITECT OF KINGS

BY JANE HOLTZ KAY

America's elder statesman of architecture has all too often played havoc with urban design.

2 FIRST LINE

4 LETTERS

11 TRENDS

Acoustic Levitation in Space Speech Recognition Advances Junk in Space Prospecting with Plants Radiation on the Job The Science of Smell Minitrends

20 LANGDON WINNER

"Competitiveness" won't work as a political vision.

22 LESTER THUROW

Stability in the U.S. economy is making people nervous.

FORUM

24 ROBERT B. REICH
The nation's economic future

demands that cooperation and creativity become tenets of public education.

BOOKS AND COMMENT

- 73 COPING WITH DISASTER Bhopal: Anatomy of a Crisis
- 74 POWER OF POSITIVE THINKING
 The Health of Nations

78 M.I.T. REPORTER

COVER

Design by Nancy Cahners

ARMS CONTROL

TechnologyReview

PUBLISHER

William J. Hecht

EDITOR-IN-CHIEF John I. Mattill

MANAGING EDITOR

Jonathan Schlefer

DESIGN DIRECTOR

Nancy L. Cahners

DESIGN/PRODUCTION MANAGER Kathleen B. Savre

SENIOR EDITORS

Sandra Hackman, Robert Howard, Sandra Knight, Susan Lewis,

Marc S. Miller

ASSOCIATE EDITORS

Beth Horning, Faith Hruby, Laura van Dam

ASSISTANT PRODUCTION MANAGER Lori Nollet

PRODUCTION/EDITORIAL ASSISTANT Valerie Kiviat

ASSISTANT TO THE EDITORS

Sherrie Saint John PRODUCTION ASSISTANT

Anne Paul

BUSINESS MANAGER

Peter D. Gellatly

CIRCULATION DIRECTOR

Beth A. Rosner

SUBSCRIPTION SERVICE MANAGER Dorothy R. Finnerty

CIRCULATION/ADVERTISING

ASSISTANT

Anne Detweiler

ACCOUNTING

Letitia A. Trecartin

ADVISORY BOARD

Edward T. Thompson

Chairman

O. Reid Ashe

Wichita Eagle-Beacon

William Bennett

Harvard Medical School Health Letter

Claude W. Brenner Commonwealth Energy Group, Ltd.

Robert C. Cowen

The Christian Science Monitor

Edwin Diamond

Department of Journalism, N.Y.U.

David E. Gushee

Congressional Research Service

Shirley Jackson AT&T Bell Laboratories

Fred Jerome

Scientists' Institute for Public Information

Robert W. Mann Dept. of Mechanical Engineering, M.I.T.

Victor K. McElheny

Knight Journalism Fellowships, M.I.T.

Louis Menand III

Department of Political Science, M.I.T.

Lester C. Thurow

Sloan School of Management, M.I.T.

Frank Urbanowski

The M.I.T. Press

FIRST LINE

FROM THE EDITOR

A Footnote on Whistleblowing

OST discussions of whistleblowers in science and technology emphasize their importance and the need to assure their protection from retribution by those on whom the whistles are blown. There is good reason for this, as Rosemary Chalk made clear early this year (see "Making the World Safe for Whistleblowers," January 1988).

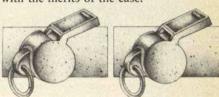
But this topic, like most at the interface of technology and policy, has more than one dimension. Consider the recently publicized challenge to the validity of some 1986 results from the Center for Cancer Research and Whitehead Institute at M.I.T. and from Columbia University on a technical issue in genetic immunology.

The need for protection so well set forth by Chalk is highly appropriate in this case: the whistleblowers-Walter Steward and Ned Feber of the National Institutes of Health and Margo O'Toole and Charles Maplethorpe, two former associates of the researchers whose work is in question have challenged two prestigious institutions and (among the authors) a Nobellaureate scientist, David Baltimore. These are intimidating opponents, and one of the complainants has alleged damage to her professional career because of her charges.

But given the style and strategy of the first public airing of the controversy, the whistleblowers were not well served even by those who may have reason to support their cause. The occasion was a public hearing by the House of Representatives Oversight and Investigations Subcommittee, whose witnesses did not include the researchers whose work is challenged. It was not a situation designed to weigh the facts of the case. Instead, the hearing room became the stage for a political drama the goals of whose cast seemed threefold-to embarrass "the establishment" in the fastmoving field of genetic science and technology, to inflate the visibility and political leverage of the subcommittee chairman, Rep. John Dingell (D-Mich.), and to press the National Institutes of Health into fulfilling its obligation to promptly and impartially study charges of improprieties whenever and by whomever made.

No one can argue with the last of these goals. But the first two are irrelevant and inappropriate responses to the whistleblowers' charges, suggesting the possibility that the whistleblowers themselves may have been motivated or manipulated by politics as much as by their devotion to

accuracy and fairness in bioscience. The lesson is that while whistleblowers properly claim the privileges that Rosemary Chalk so effectively set forth, they have a responsibility, too: to eschew roles and situations in which the controversy they inevitably create can be subverted to personal agendas that have too little to do with the merits of the case.



HAIL AND FAREWELL

N this issue, we introduce the first of a new series of essays by Langdon Winner (see page 22), who has joined our roster of columnists and will appear here in alternate issues, four times a year.

Winner is associate professor of political science at Rensselaer Polytechnic Institute, where he teaches in the Program on Science and Technology Studies. Some readers will find his name familiar as the author of two well-received books about technology and society: Autonomous Technology: Technics-Out-of-Control as a Theme in Political Thought, and The Whale and the Reactor: A Search for Limits in the Age of High Technology. As these titles suggest, Winner is a political theorist who specializes in social and political issues generated by modern technological

In gaining Winner's essays we have sustained a loss to which long-standing readers of the Review will be especially sensitive: Robert C. Cowen has asked to be relieved of his assignment for regular contributions. Cowen has written for the Review as a columnist since 1966-meeting in more than 20 years a total of nearly 200 deadlines with timely and perceptive reports. Throughout that period he has also been a member of our Advisory Board, a wise advocate and counselor to the magazine's sponsors and editors.

Few magazines can claim from any single contributor such a prodigious flow of both creativity and support, and no expression of thanks is really adequate. Fortunately, Cowen will continue as an adviser and—we trust—a contributor on topics of special interest.

of J.Laziu



Technology Review

(ISSN 0040-1692), Reg. U.S. Patent Office, is published eight times each year (January, February/March, April, May/June, July, August/September, October and November/December) at the Massachusetts Institute of Technology. Entire contents © 1988 and published by the Association of Alumni and Alumnae of M.I.T., Building W59, Cambridge, MA 02139. Printed by Lane Press, Burlington, Vt. Second-class postage paid at Boston, Mass. and additional mailing offices. Postmaster: send address change to Technology Review, M.I.T., Building W59, Cambridge, Mass. 02139.

Editorial, circulation, and advertising offices: Technology Review, Building W59, Mass. Institute of Technology, Cambridge, Mass. 02139 Tel. (617) 253-8250 Fax #617-258-7886.

Advertising representatives:

The Leadership Network: 254 Fifth Ave., New York, N.Y. 10001 (212) 684-5500; Benson Co., Park Ridge, Ill.; Colin Smith Agency, Berkeley, Calif.; J. T. Kelly Associates, Dallas, TX (214) 380-0416; IMI Corp., Tokyo, Japan; J. J. Arcisc Co., Boston, Mass.; and McKeldin Co., Atlanta, Ga.; Littel-Murray-Barnhill, P.O. Box 1405, Morristown, N.J., 07960-1405.

Subscription inquiries and change of address: Building W59, M.I.T., Cambridge, Mass. 02139 Tel. (617) 253-8292.

Prices:

Subscriptions, one year: libraries and organizations \$27; all others \$24. Canada add \$6; other foreign countries add \$12. Single copies and back issues available. All prices U.S. funds.

U.S.A. newsstand distribution by Eastern News Distributors, Inc., 1130 Cleveland Rd., Sandusky, Oh. 44870, Tel. 800-221-3148.

TechnologyReview SUBSCRIBER SERVICES

If you ever have a question or problem, just send your mailing label with a brief note to the address below.

If you're moving – Please give us 4 weeks notice.

Attach your label and fill in your new address below.

If you're subscribing or renewing—Check the appropriate box below and fill in your name and address. Send with your payment (\$24 per year, Canadian, add \$10; Foreign, add \$20) to the address below.

If you want to be unlisted—Occasionally we make our mailing list available to other quality publications or organizations. If you prefer to have your name removed from this list, please attach your label and check the appropriate box below.

If you want to give a gift – Send both the name and address of the recipient and your name and address, with payment, to the address below.

□ New Subscription □ Renewal □ Gift □ Please Unlist My Nam □ Please Change My Ac	
Name	
Address	

Mail To: Technology Review P.O. Box 978 Farmingdale, NY 11737

State

7641TR

LETTERS

The Technology-Culture Nexus



TECHNOLOGY AND SOCIAL VALUES

I have noted with some chagrin that Daniel Grossman could not have read my book Tradeoffs very carefully and may have inadvertently misled readers in his review of it ("Technology's Crystal Ball," November/December 1987). For example, he faults the book for showing a lack of awareness about how technological artifacts reflect the culture that spawns them. How could he have missed the entire first chapter, which is devoted to vital connections between technology and culture? Moreover, the book consistently treats technology as a social process throughout.

Grossman also characterizes as "timid" a proposal I make as an aside on the question of R&D priorities, but he completely overlooks my major recommendations for action. Although he confidently puts down my key questions as the "wrong ones to ask," he doesn't help the reader by posing the "right" ones.

Perhaps much of the reviewer's unhappiness stems from his ideological perspective, which he reveals when he criticizes me for my "unwillingness to embrace bona fide democratic reforms, such as citizen control of technology from development to marketing." In subordinating the primary themes of *Tradeoffs* to his own political agenda, Grossman seems to undercut *Technology Review*'s high standards of journalism.

EDWARD WENK Seattle, Wash. The author responds:

I must stand by my assertion that *Tradeoffs* is weak on recommendations for increasing the role of citizens in technological change. Granted, Wenk proposes a number of means to ensure that the public is alerted to the latest technical findings. Yet however beneficial these channels might be, what we need are reforms enabling citizens to use knowledge effectively. As far as I can tell, Wenk's only advice in this regard is that citizens should "share their insights on particular issues ... with elected officials." Hardly novel and unlikely to yield notable results.

If by proposing bona fide democratic reforms I stand accused of an ideological perspective, I plead guilty. Unless citizen participation permeates all stages of the technology process, it will only ratify a fait accompli. I would have thought that this is a "political agenda" Wenk and I could agree on.

I must apologize if I implied that Wenk denies the technology-culture nexus. However, Wenk's conception of these relationships fails to account for their full richness. He notes that "technology should be an instrument to achieve social ends, not an end in itself." Culture and technology, according to this view, are separable phenomena mediated by fixed values. But as I pointed out in my review, such a perspective is simplistic, since technology is actually part of culture and alters malleable values. The title of a recent book, *The Car Culture*, testifies to this.

MODELING NUCLEAR HOLOCAUST

As a "nuclear winterist," I was quite offended by the opinionated accusations of software engineering auditor Michael Dutton ("Opinionated Computers" in Letters, April 1988). His claim that winterists have fudged their computer model to support their political convictions is absurd. So is his statement that nuclear winter has been reduced to nuclear overcast. True, Carl Sagan publicized an extreme scenario of nuclear winter early on, but the research that has been done in the years since has strengthened, not weakened, the scientific underpinnings of the theory.

An extensive observation program funded by the Defense Department's Nuclear Agency—as well as detailed computer modeling conducted at institutions Continued on page 7

SCIENCE / SCOPE®

The feasibility and benefits of adapting the Free Electron Laser (FEL) to perform precision radar measurements in space will be examined under a new Hughes Aircraft Company program. Scientists will study the potential of the FEL as a compact space-radar transmitter that would be part of a Strategic Defense Initiative (SDI) system for discriminating objects in space. The program will take advantage of the FEL's inherent tunability, high power and efficiency, and its ability to operate in frequency bands of 100 GHz and higher. The program's ultimate goal is a space-based, multiband, adaptive FEL capable of operating efficiently at randomly chosen, stable frequencies.

A new orbiting sensor system could potentially serve as a space-borne missile warning system. Under development for the Strategic Defense Initiative Organization (SDIO), the Boost Surveillance and Tracking System (BSTS) satellite is designed to maintain continuous surveillance of Earth. Hughes will develop the system's infrared sensor and signal processor, which will be able to provide reliable detection of hostile missiles, even in severe countermeasure environments. The design will be developed to incorporate an efficient modular growth path to meet all of the SDIO's future requirements for the BSTS satellite.

A new technique for interconnecting high lead-count integrated circuit (IC) chips to a substrate or package is being developed as a software and hardware package in a single piece of equipment. Called single-point Tape Automated Bonding (TAB), the Hughes system uses an etched tape, typically formatted in 35-mm or 70-mm sizes, on which a specific IC pattern is etched out. A polyimide film is used to separate and support the leads used for the interconnects. Single-point TAB combines the speed and precision of tape-automated bonding with wire bonding's ability to handle a wide variety of chip shapes, including the latest very large-scale integrated chips.

A new Dome Display System will incorporate background and other target projectors with twice the resolution and twice the targets of those previously simulated by other trainers. The system, provided by Hughes, will be used in Lockheed's YF-22A Advanced Tactical Fighter (ATF) prototype development program. The display will include a 28-foot dome and other equipment similar to that used in Hughes' F/A-18 Weapons Tactics Trainers. The Dome Display System is one of several ATF programs currently being developed by Hughes.

Hughes' Santa Barbara Research Center has openings for qualified applicants experienced in Infrared Systems and Program Engineering activities. You will be responsible for developing design verification plans, preparing radiometric performance predictions, and applying advanced technology to Infrared Sensor Systems. If your experience includes infrared sensor design, detector technology, and low noise analog circuits, contact the Santa Barbara Research Center, Professional Employment, Dept. S2, 75 Coromar Drive, Goleta, CA 93117. EOE. U.S. citizenship required for most positions.

For more information write to: P. O. Box 45068, Los Angeles, CA 90045-0068



Nuclear energy, <u>not</u> foreign oil, is the best way to prevent electricity shortages

Electricity is so vital to our economy and our way of life that a shortage of electricity is unthinkable. Yet some parts of the country are already experiencing brownouts during peak periods of demand. The question is not "Will we run out?" The question is "What price will we have to pay?"

Our electricity demand will outgrow our present supply. It is only a matter of time. Federal planners believe that our current generating capacity may not be enough to supply our peak electrical demand in the 1990s.

America's electricity use has steadily increased for the last 50 years, and has grown over 45% since the 1973 Arab oil embargo. This growing electricity demand is already forcing us to turn to oil.

Imported oil: a dangerous fix

The longer we wait to build new coal and nuclear plants, the more



we will have to depend on oil. Using more oil plants would increase our foreign oil imports, worsen our trade deficit, and make America even more dangerously dependent on foreign countries for crucial energy.

More nuclear plants needed

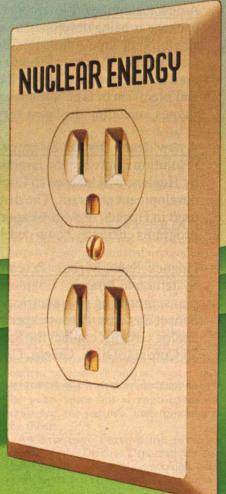
Nuclear energy is already America's second largest source of electricity after coal. By reducing the use of foreign oil to make electricity, nuclear plants have saved America \$105 billion in foreign oil payments since 1973. Nuclear plants have also helped cut consumer electric bills by over \$60 billion.

Nuclear energy reduces America's dependence on foreign oil, not only at electric power plants, but wherever electricity replaces oil. It supplies a large part of the electricity that our economy needs to prosper.

If you'd like more information on making America more energy independent, write to the U.S. Council for Energy Awareness, P.O. Box 66103, Dept. SH19, Washington, D.C. 20035.

Information about energy
America can count on
U.S. COUNCIL FOR ENERGY AWARENESS







such as Los Alamos and Livermore national laboratories, the National Center for Atmospheric Research, and the British Meteorological Office—have not only validated the nuclear winter theory but uncovered mechanisms that make the climatic effects more serious than originally thought. Furthermore, biological systems have been found to be more sensitive than realized, so lack of food would be a major problem for most people surviving nuclear holocaust.

Dutton is also wrong to say that the nuclear winter theory has detracted from anti-nuclear activism. In fact, publicity on the theory has reawakened global concern for the effects of nuclear war and forced us to realistically confront them, whereas the average person heretofore repressed these thoughts as too horrible to contemplate. The first lines of the Intermediate-Range Nuclear Forces Treaty refer to nuclear winter, and the United Nations has recently released a report on the subject.

We owe a debt to the techniques of computer simulation that allow us to conduct experiments that we cannot do in the real world, and that can warn us of dangers before we experience them. Only with these powerful tools can we discover the consequences of foolish actions and prevent them before it is too late.

> ALAN ROBOCK College Park, Md.

Mr. Robock is associate professor in the Department of Meteorology at the University of Maryland.

MICROORGANISMS ON THE LOOSE "Biotech Waste" by Shawna Vogel (February/March 1988) is a waste indeed. It is naive, represents an extremely narrow perspective, and contains substantial inaccuracies. Vogel notes that the small fraction of genetically engineered microorganisms (GEMS) that survive sterilization "could constitute what is called a deliberate release." GEMS "can escape undetected and unregulated," she says. Such statements are uninformed and seem calculated to alarm and mislead.

First of all, the issue of deliberate release is a gratuitous bogeyman. Deliberate releases of innumerable insects, bacteria, and viruses in small-scale tests have long occurred. These organisms were, until recently, exempt from U.S. pesticide and toxic-substances statutes. R&D experiments on organisms not used for pesticides are still exempt.

Moreover, the concepts of containment and release are only relative. Many genetically engineered products licensed by the Food and Drug Administration (FDA) involve widespread dissemination of organisms into the environment-including the vaccines for polio, measles, rubella, vaccinia, mumps, yellow fever, and influenza. The organisms used to make such FDA-regulated foods as yogurt and cheese are often dispersed to some degree as well. Low-containment laboratory facilities also permit microorganisms to pass in and out. Thousands of different genetically engineered clones have unquestionably escaped, and it would be difficult to estimate the much larger number of non-recombinant mutants that have been dispersed without adverse effects.

Finally, it is wrong to imply that the wastes from the numerous industries using biotechnology are ignored. Many local, state, and federal laws regulate laboratory and industrial emissions, and all products for testing or marketing are subject to the National Environmental Policy Act, which requires regulators to consider the possible impacts on the environment.

HENRY I. MILLER Rockville, Md.

Henry I. Miller is special assistant to the commissioner of the Food and Drug Administration.

The author responds:

Mr. Miller puts forth an overused and invalid argument: that since genetically engineered organisms haven't caused any adverse effects so far, there is no reason for concern. Officials at the Environmental Protection Agency deal with the socalled gratuitous bogeyman by carefully reviewing all field-test proposals for potential environmental hazards. The implication of my article was not that biotech waste is being ignored, but that it should undergo the same review process as other organisms destined for release.



WASHINGTON WEEK IN REVIEW:

Exploring the issues that shape our times

Each week, noted journalists analyze the events that affect our lives on "Washington Week in Review," public television's longestrunning public affairs program.

Now in its 22nd year. "Washington Week in Review" provides a probing in-depth look at what is happening in the nation and the world.

Ford Motor Company, in its tenth consecutive year, is proudly joined by Ford Aerospace in underwriting this informative program.

"Washington Week in Review" is produced by WETA in Washington, D.C. Consult your local listings for day and time in your community.



Whatever your problem, I'll solve it.

I'm Riva Poor and your success is my business.

I've helped hundreds of successful people achieve the Results they want in life. And I can help you.



I'm a professional problemsolver who can help you solve your problems. I can help you identify THE REAL YOU, WHAT YOU REALLY WANT and HOW TO GET IT. I can provide you with new ways of looking at yourself, your business, your personal relationships or whatever is important to you. I can rid you of any negative attitudes keeping you from attaining your goals. I can catalyse your best thinking.

You will get clarity, reassurance, direction, self-confidence. Results! More money, power, achievement, productivity, leisure time, better family relations, whatever is important to you.

My clients are the proof. And they'll be pleased to talk with you.

Challenge me now. Call me to explore what I can do for you. No charge to explore and no obligation.

Your success is my business. Why Wait? Call me. Right now.

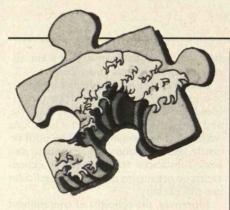


"The Dr. Spock of the business world" - National Observer. "Mother of the 4-day week" - Newsweek. Originator of Dial-A-Decision to give you immediate Results regardless of distance.



Riva Poor, Management Consultant 73 Kirkland St., Cambridge, MA 02138 617-868-4447 Dept. TR-3

©1980 Riva Poor



RESPONDING TO JAPAN

Robert Chapman Wood's "The Real Challenge of Japan's Fifth Generation Project" (January 1988) gracefully presents a clear summary of the progress and goals of Japanese government computer research. However, I disagree with the author's conclusion that U.S. efforts to respond to Japanese technological challenges are likely to fail. I also find it difficult to sympathize with his apparent yearning for a world whose problems can be solved through a series of long-range engineering and technology projects.

The United States does have research projects aimed at Fifth Generation goals. But our country has a more sophisticated and dynamic research culture than Japan. While Japanese corporations and government agencies foster institutional memory by maintaining research teams over many years, U.S. researchers are much more mobile. This chaotic character of the U.S. technology effort results in a distribution of human resources more likely to lead to new concepts and applications.

For example, Wood's technocratic vision of allocating resources ignores the sources of U.S. strength in the computer field. Computer research on the Strategic Defense Initiative encompasses many of the most advanced technology applications and dwarfs all Japanese government projects. From one viewpoint, such military spending is equivalent to throwing the resources into the sea, in President Dwight Eisenhower's phrase. From another viewpoint, the project represents a continuity of effort that continues to attract Japanese investment in this country.

More profoundly, Wood fails to recognize the integration of the U.S. and Japanese economies and technological goals. The Japanese Fifth Generation project would be meaningless without an extensive U.S. market for its eventual products.

> WILSON P. DIZARD III Arlington, Va.

HIDDEN MEDICAL DECISIONS

I found "Children Who Need Technology-and Parents" by Kathy Fackelmann (January 1988) well-written and informative. Yet while I believe strongly in the rights of the individual, I am uncomfortable with spending millions of dollars on premature, underweight infants who will remain dependent on technology.

Deciding whether to support advances in technology is extremely complicated, and I feel that it is often done without a sufficient understanding of the issues. Further, many of the choices as to what types of health care should be provided are governed by the incentives from insurance companies and other such establishments. Advances in technology have given us the opportunity to create a golden age. We can do more than ever before, but we ourselves must decide what we will do. The alternative is to allow "hidden" decisions to be made by the interplay of legal and economic systems—a scenario that often leads to an inefficient use of resources.

> STEPHEN CALLAGHAN Chicago, Ill.



SUPERCONDUCTOR SALES PITCH

Congratulations to Simon Foner and Terry P. Orlando for telling the truth about the new high-temperature superconductors ("Superconductors: The Long Road Ahead," February/March 1988). Now I can refer to an article rather than give my usual five-minute discourse on how this field is being oversold. There is much promise, but if people believe 10 percent of some predictions, high-temperature superconductors will yield great disappointment, and the hype might provide more harm than help to the field in the long run.

> THOMAS W. EAGAR Cambridge, Mass.

Thomas W. Eagar is a professor of materials engineering at M.I.T. Continued on page 70

Excellence. Time after time.





Discount

SPREADSHEET

AT LEAST

98 37

94

\$ 75

105 60

149

THOUSANDS OF SOFTWARE TITLES AT BIG DISCOUNTS! CALL US IF IT IS NOT LISTED HERE—WE HAVE IT!

SOFTWARE FOR "IBM"	Lotus 1-2-3 2.01
ACCOUNTING	Microsoft Excel 2.0
Business Builder	Multiplan 3.04
DAC Easy Actg 2.0	Quettro 129
Dollars and Sense 3.1	Surpass
Managing Your Money 40	Swift & Easy
Managing Your Money 4.0	Swiftcalc PC w/Sideways42
Quicken 2.0	Surpass 278 Swift & Easy 37 Swiftcalc PC w/Sideways 42 VP Planner 55
Smart Money	UTILITIES
	Descryiew 78
COMMUNICATION	DOS Rx \$60 Fastback 5.14 93 Genifer 213 Keyworks 3.0 74 Mace Utilities 4.10 55
Carbon Copy Plus \$118 Crosstalk MK 4 128 Crosstalk XVI 93	Fastback 5.14
Crosstalk MK 4128	Genifer
Crosstalk XVI	Maco Utilities 4.10
IS Talk	Memory Mate 30
Relay Gold 2.0	Memory Mate 3.0
Relay Silver 1.0	PC Tools Deluxe 42 59
Side Talk	Quick Index III 111 Runtime 112 Sideways 3.2 41
Transporter 1.4	Huntime
DATABASE	SOZ Plus
@Base	SQZ Plus 59 Turbo Lightning 57 Windows 2.03 63
dBase III Plus 398 Data Manager PC 30	Windows 2.03 63
Data Manager PC	WORD PROCESSING
Database Manager 2 221 dBXL 1.2 149	Deals Ot Whites Dive
Enable 20 408	Celebrity 67
Enable 2.0	Easy Extra 1.5
PC Converter Plus 60	Bank St Writer Plus
PFS: First Choice 2.0	Multimate Adv. II
Q & A 3.0	O & A Write
Rapid File 1.2	Samna Word IV 446
Reflex 1.14	
Thinktank 2.4.1	WordPerfect 4.2
GRAPHICS	Word Finder
Design CAD 3.0168	Coffee of the ACINTOCH
Gem III Draw Plus	Software for "MACINTOSH
Generic CADD 30	dBASE MAC\$298
Grash 30	Clickart Publications
Harvard Graphics 2.1	Copy II Mac 7.1
Grasp 3.0	Decision Map 108 Dollars & Sense 4.0 112
Microsoft Chart 3.0	Draw It Again Sam
Newsroom Pro	Easy 3D112
Print Shop	Fastback 1.01
PFS Graph 105 Print Shop 39 Print Shop Companion 30	In Talk 3.0
Sign Master 6.2	Lazerstart 2.5
LANGUAGES	MAC Vision 2.0
Basic Compiler 5.36	Microsoft Excel 1 06 296
Lattice C Compiler 3.2	Microsoft Works 1.1
Macro Assembler 5.0	Microsoft Multiplan 1.11
Pascal Compiler 3.32	Pixel Paint
Smart Guide for DOS	Power Point 1.0
Turbo Basic 1.1	Power Point 1.0 228 Printworks for MAC (Laser) 109
Turbo C 1.5	Ready Set go 4.0
RM Basic 450 Smart Guide for DOS 22 Turbo Basic 1.1 60 Turbo C 1.5 60 Turbo Tutor 4.0 60	Spellswell 2.0
PROJECT MANAGEMENT	Ready Set go 4.0
Gem Desk Top Publisher	Turbo Tutor
Gem Desk Top	Typing Tutor IV
Gem Desk Top	Voila
Timeline	Write Now 2.0
PRIORIE PIUS III	F D-4-14- C-44

NEW!HOT!TITLES SOFTWARE FOR "IBM Ability Plus 1.01 . . Fastback Plus 1.01 File Rescue Plus . Networker Plus 2.0. Norton Guides for OS/2 API Page Perfect. Quick Basic 4.0 VP Planner Plus 2.0 Software for "MACINTOSH Bookmark MAC 1.0 Lap Link MAC . . . MAC SQZ Quicken (for MAC) Timeslips III MAC CALL TOLL FREE 800-222-2665 IN CT. CALL (203) 359-1660 8:00 am-5:30 pm, Mon. thru Fri. WHY YOU SHOULD ORDER FROM THE BOOK OF DISCOUNT SOFTWARE: 25% or MORE Off List Prices on All Software **► NO HIDDEN CHARGES** No Shipping Charges on Credit Card or Pre-paid Orders No Handling Charges Ever Credit Card Convenience VISA Your ONE SOURCE for Thousands of Software Titles-All at Discount Prices. No Membership Fee --- MAIL IN FOR FREE HANDBOOKS -Discount BOOK OF SOFTWARE!

PLEASE RUSH ME MY FREE COPY OF:

ALSO! NEW!

■ Book of Books™

Cataloging 12,000 Scientific and Technical Books from 14

leading pu	פוסוופוום	
Name		
Company		
Address		
City	State	Zip
Or Sand Busines	e Card	

MAIL TO:

OMEGA PRESS An OMEGA Technologies Company

Eight Omega Drive, P.O. Box 4182 Stamford, CT 06907 © COPYRIGHT 1988, OMEGA PRESS, INC. ALL RIGHTS RESERVED, PRINTED IN USA

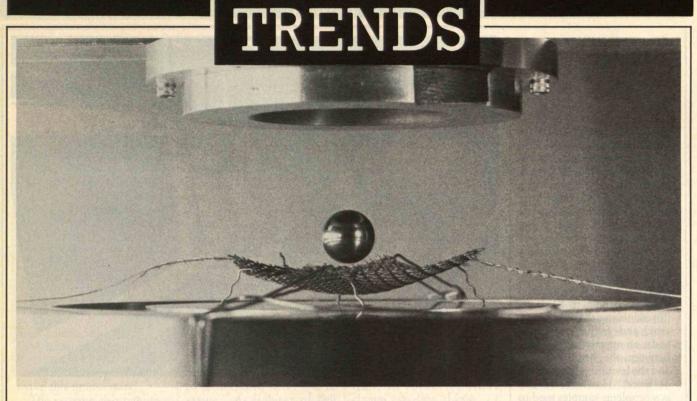
At OMEGA PRESS we strive to offer the very latest software packages, including version changes. At times however discontinued packages may affect our advertised programs.

WE HAVE THEM ALL!

Poter Norton Nantucket MASTER GRAPHICS' SERIES ASHTON TATE

PRICES SUBJECT TO CHANGE WITHOUT NOTICE. Defective Software will be replaced immediately.

Simon&Schuster Software



Look Ma, No Hands

pace scientists are working hard to recreate the magician's classic illusion—levitation. The purpose is not to dazzle the innocent but to employ new chemical techniques made possible by the weightlessness of space. Over the last decade and a half, scientists and engineers have been experimenting with using sound waves, electricity, and magnetism as "joy sticks" to turn, shake, and stabilize materials floating in near-zero gravity.

The researchers want to harness the potentially revolutionary advantages of "containerless manufacturing" for applications aboard space stations and shuttles. Materials refined without touching a container's walls-literally in midair-wouldn't be besmirched by the impurities that come off crucible surfaces. Moreover, a containerless system could operate in heat that would melt any crucible, and because materials don't touch any walls, they might remain liquid at higher temperatures.

Theoretically, scientists could exploit this phenomenon to produce states of matter that are impossible on earth. "If you cool [the space liquid] and then solidify it, you can have different states of matter," says Martin Barmatz, a researcher with NASA's Jet Propulsion Laboratory (JPL) in Pasadena, Calif. Containerless, spacebased experiments have already yielded novel forms of glass.

Among the most promising techniques is acoustic levitation-sound. High-intensity sound sources generate waves, and one or more reflectors bounce the waves back. This creates a force field that holds an object in midair. in some ways analogous to the way a cork remains still in reflected waves of water. The object is manipulated by changing a variety of parameters—the frequency or phase of the sound waves or the position of the reflectors. For example, two loudspeakers generating sound waves out of phase will create a field that will twist and turn objects.

So far, only small samples have been processed this way. Surprisingly, the primary size limit has to do with dimensions rather than weight-a sample must be significantly smaller than the sound wavelength. Large samples interfere with the sound waves, weakening the field. IPL researchers have lifted only centimeter-sized samples on earth, but according to Barmatz, theoretically objects as large as a ping-pong ball could be controlled.

Getting prototype levitation systems into space has been difficult, particularly since the 1986 space-shuttle explosion. Nevertheless, there have already been some successes. On a 1985 shuttle mission, an acoustic system produced by Intersonics, Inc., of Northbrook, Ill., operated at temperatures ranging from 900° to 1,550° C. It controlled glass formed into a hollow sphere.

Catch the Wave

Acoustic levitation does have drawbacks, however. The

Scientists hope to use sound waves to control materials that will be manufactured in space laboratories.

systems can be noisy-some models sound like police sirens, Barmatz says. Also, extremely high-temperature furnaces may be needed, which is a problem because heat scatters sound waves. The higher the oven temperature, the lower the lifting power. Moreover, it is hard to find good sound-transmitting systems that will not melt at high temperatures. Probably the greatest shortcoming is that sound waves propagate in a gas, not in the vacuum beyond earth's atmosphere.

To get around these inherent difficulties, researchers are looking at a number of systems that would complement acoustic levitation. One is levitation on electromagnetic waves, a technique initially developed by Westinghouse Electric Corp.

While this approach works only on materials that con-

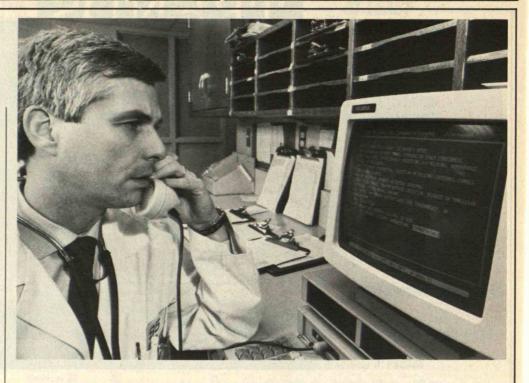
duct electricity and hence could be magnetized, it could handle larger samples. Plus it has a side benefit. In experiments on earth, placing a two-centimeter sample between two electromagnetic coils not only lifted it but melted it.

In the late 1970s, the U.S. Space Application Rocket 3 also showed that electromagnetic coils could melt materials. According to Barmatz, "By adjusting the shape, current, and frequency of the coils, an appropriate balance between the heating power and the levitating form can be obtained." However, stability is a problem: samples tend to rotate. In addition, electromagnets demand high power and large support machines.

JPL experimenters have looked at levitators based on static electricity as well. Their chief disadvantage is that they work only with materials that take on surface charges, but fortunately, glass is one such material. By contrast, acoustic devices can control any material-metals, glasses, plastics.

Since levitation is so important to material processing in outer space, it is not surprising that several nations are investigating it. Ulrich Huth, who heads the European Space Agency's Washington, D.C., office, says his organization plans a hybrid levitating furnace for its part of the U.S. space station. Mamoru Mohri, a Japanese shuttle-payload specialist, reports that his country is developing such a system for its own space laboratory. Japan also hopes to place hybrid furnaces on its module for the U.S. station.

STEPHEN STRAUSS, a regular contributor to Trends, is a science reporter for the Globe and Mail in Toronto.



A Machine to Talk To

ou want to fly from New York to Denver on Saturday around 4:00 P.M. So you phone the com-

"Flight number one-six leaves New York at 4:50 P.M.; arrives in Denver at 7:00," the computer voice informs you.

"What stops are on this flight?" you ask.

'This flight makes no

"How much is the fare?" "Three hundred sixty dol-

"I want flight one-six."

"Your reservation is confirmed. Thank you."

AT&T's Bell Labs developed the program to handle this conversation eight years ago. But it has never left the laboratory, illustrating both the progress and the difficulties that have beset the field of speech recognition.

The reservation system remains strictly a research tool because it recognizes only 127 words and requires an extremely rigid syntax. "If you learn the syntax and vo-

cabulary, it works great," explains Lawrence Rabiner, head of the Speech Research Department at Bell Labs. "But people don't say things the same way every time. So you can't use it in the real world."

Speech-recognition products, however, are starting to find real-world applications. In one dramatic case, Lynn Olsen-who is blind-competed in the 1986 Pacific Cup San Francisco-to-Hawaii sailboat race using navigation information from a personal computer he spoke to via a headset and microphone. And Dragon Systems of Newton, Mass., sells a 1,000-word speech-recognition system that Xerox used in a 1986 inventory audit of 2.2 million

The broadest applications are emerging in medicine and law, fields involving a lot of dictation. Last year, radiologists in over 50 U.S. hospitals dictated x-ray reports to VoiceRAD, a voice-to-computer system sold by Kurzweil Applied Intelligence. VoiceRAD can recognize **Arthur Chambers (above)** writes and edits medical reports on this computer-using only his voice.

words with a 98 percent accuracy and is useful for the fill-in-the-blank information that is sufficient for about 80 percent of radiology reports, according to Dr. Alan Robbins at Tufts Medical School, who helped develop the system. At the end of an exam, the doctor says "print this" and gets a ready-to-edit man-

With a 1,000-word vocabulary in each of five modules applicable to different types of tests, VoiceRAD streamlines the task by using standard formats and trigger phrases. A physician speaks a few key words and the computer inserts a routine paragraph. An updated version, VoiceRAD-MX, should cover 90 percent of radiology exams and include a vocabulary of up to 10,000 words. Kurzweil offers a similar package for emergency-room physicians, who spend as much as 30 percent of their time writing often illegible reports,

says Arthur Chambers of the Nash General Hospital, who helped design that system.

For businesses, IBM has recently developed a 20,000word dictation system that runs on a modified AT-class computer. Currently being tested, it includes 97 percent of the words a business person is likely to use.

On the negative side, people speaking to the IBM and Kurzweil equipment must pause briefly between words. Fred Jelinek, who headed the IBM research effort, predicts that it will take three to five years to develop a way to make this unnecessary.

The systems also require a 20- to 90-minute "training" session to familiarize the machines with an individual's voice. Jelinek believes that because of the wide variations in people's voices, it may take years to eliminate this drawback.

Football or Jungle

Other simple applications are on the verge of being introduced. For example, AT&T has successfully tested a "calldistribution" system at AM-TRAK. Callers obtain information about train arrivals, departures, or fares by saying "one," "two," or "three." Unlike some current systems that require callers to press a button to select an option, AT&T's concept also works on rotary phones. The approach can take over tasks normally handled by human telephone operators, and AT&T plans to market it to railroads and other operations this year.

Analysis techniques that identify a user's unique speech "signature" may protect computerized databases, according to Dean Hester of Bell Labs. "Today hackers are able to access databanks or

make unauthorized phone calls simply by using a password. Speech-verification systems can screen them out."

However, obstacles to the fullest use of speech recognition remain, many of them based in linguistics as much as in computer technology. John Makhoul at Bolt, Beranek, and Newman is leading an effort to develop a system that will help naval officers keep track of their ships. That task is complex enough, says Makhoul, but "even when you have a system that can recognize words with 100 percent accuracy, it also has to understand what you're saying." As Rabiner of Bell Labs asks, "If you say, 'The Lions killed the Bears,' are you talking about football or the jungle?"

Misunderstandings can also arise because "people often don't say what they mean," says Mitchell Marcus, a professor of cognitive science at the University of Pennsylvania. "You have to infer their meaning." For example, "if you ask a computer, 'Can you tell me which division had the highest gross income in 1987?' the answer you want is not 'yes.' "

Ultimately, he says, you'd like a machine capable of understanding fluent, colloquial English—a machine with which you could actually converse. He doesn't think we'll reach that point without a better understanding of the structure of spoken English.

When will that happen? Rabiner estimates it will be two decades or more before you can talk to a computer the same way you talk to humans. "We may not have a machine like HAL by the year 2001, but maybe by 2010." □

STEVE NADIS is a regular contributor to Trends.

Space Junk

stronauts aboard a 1983 shuttle awoke one morning to discover a small pit in a window. NASA investigators later concluded that a tiny paint chip—debris from a booster, a satellite, or an earlier shuttle-had created the dent.

Three decades into the space age, the amount of junk orbiting the earth has mushroomed-everything from long-dead satellites, which outnumber working satellites, to rocket boosters, clamps, satellite shields, explosion bolts, and even sewage. Paint flakes wouldn't ruin the shielding of a shuttle or a space station, but "if an astronaut working outside is struck by a flake of paint, it could be fatal," warns Lt. Col. L. Parker Temple of the air force secretariat's Office of Space Plans and Policy.

According to Don Kessler, NASA project scientist for orbiting space debris, more than

90 satellites, booster stages, and other objects have broken up in space. "You will create some space debris every time you fire a rocket into space, even if it's just exhaust," says Michael Michaud, director of the State Department's Office of Advanced Technology. Most recently, the Soviet satellite Kosmos 1823 exploded in December. Kessler, who has studied space debris for over 10 years, thinks a collision with debris destroyed the craft, which had been an old target for Soviet anti-satellite (ASAT) tests.

ASAT tests themselves have worsened the situation. Soviet tests between 1968 and 1972 scattered an abundance of shrapnel in space. After a four-year hiatus, the Soviet Union resumed ASAT experiments in 1976, but positioned targets so that most debris

Artificial debris orbiting the earth is dangerous to satellites and astronauts. This map depicts objects as small as 4 inches in diameter.



would fall into low orbits and burn up as it streaked through the earth's atmosphere. However, in 1985, the United States conducted its own ASAT test, seeding space with over 100 trackable scraps of satellite remains.

Booster explosions have created even more debris. In 1986, a European Ariane booster, which had launched a French satellite nine months earlier, exploded, throwing hundreds of pieces of garbage into orbits from 270 to 840 miles above the earth. In the 1970s and early 1980s, seven U.S. Delta boosters blew up.

NASA and Department of Defense researchers have long argued that the increasing use of space heightens the risk of satellites colliding with orbiting junk. The prospect of a U.S. space station, which

Orbiting paint flakes created six craters per square inch on a satellite in space for 50 months. NASA started building this year, has fueled the concern. Metal in orbit may attain velocities of five miles per second; at that speed, a fragment the size of a marble carries a hand grenade's impact.

Andrew Potter, chief of NASA's space science branch at Johnson Space Center in Houston, Tex., says SDI researchers and designers of the Hubble Space Telescope also are anxious. Both the telescope, scheduled for an early 1990s launch, and space weapons face an estimated 50 percent chance of being damaged by space junk severely enough to lessen their effectiveness. There is a 1 percent chance the telescope will suffer the fate of Kosmos 1823.

Garbage Patrol

As with trash on earth, few easy answers exist. "Space pollution is like pollution on the ground," says Malcolm Wolfe, a senior engineer at the Los Angeles-based Aerospace Corp. "It is insidious and it's hard to reverse it."

In one approach, both NASA and the Department of Defense are seeking to limit their contributions to space trash by minimizing explosions in outer space and using low orbits for experiments like the ASAT tests. More actively, the Soviet Union and NATO have attempted to boost dying satellites into a higher orbit—a sort of breakdown lane. Other researchers have proposed that all boosters be rigged to reenter the earth's atmosphere.

However, Kessler argues that higher orbits might eventually be needed for other uses and also increase the chances of collisions in the breakdown lane. Moreover, both solutions could be costly, so private satellite vendors and nations that hope to start using space in the future are likely to oppose them.

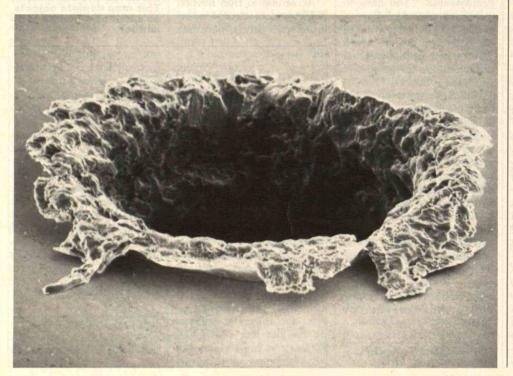
Because it is in charge of

coordinating all government space users, this summer the National Security Council will commission a study on space pollution, involving NASA, the Department of State, and the Department of Defense. The European Space Agency has also begun to consider the problem.

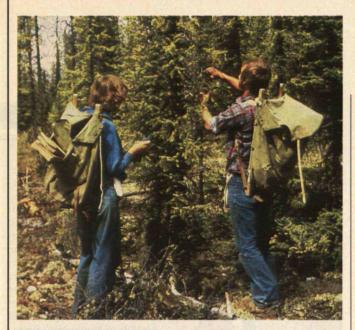
In addition, NASA is anxious to retrieve its Long Duration Exposure Facility, launched in 1984 to study a variety of space environment issues. The Challenger crew would have recovered it, but the pickup is now scheduled for the July 1989 flight of the Columbia. Researchers expect the facility to be peppered with pea-sized impact craters, providing clues to the degree and nature of small debris. Such debris poses the greatest danger, since a space station would not be able to maneuver out of its path.

To improve estimates of the dangers from space junk too small to be seen with existing equipment, NASA scientists from the Office of Space Flight and Johnson will soon propose a new radar facility. The \$10 million to \$20 million facility would identify objects down to an inch in diameter in orbits several hundred miles above the earth. Defense Department radar facilities and surveillance satellites already track larger objects.

Fortunately, space junk is a future rather than a present impediment to space activities. As the State Department's Michaud argues, "The real issue is a general increase in space operations. Any increase will create additional debris." And he warns that when junk collides with junk, "the debris will increase even if we do nothing further."



TOM KIELY is a regular contributor to Trends.



Gold in Them Thar Plants

f some scientists are right, gold prospectors can throw away their pans and start collecting plants. Proponents of "biogeochemistry" contend that vegetation may point the way to subterranean deposits of precious and strategic metals.

There are two traditional methods for locating mineral pockets. With geophysical exploration, searchers send seismic waves through the ground, monitoring the echoes for clues to the presence of certain minerals. And geochemical sampling—chemical analysis of soils, rocks, and sediments—can spot deposits if enough of a mineral is located on or near the surface.

However, both procedures can be time-consuming and expensive. Moreover, geophysical exploration is ineffective when minerals are spread out, and geochemical sampling can be misleading in areas where glaciers would have carried the top layers of soil far from underlying mineral deposits.

Biogeochemistry might overcome these problems, offering a way to quickly survey large areas. Metals often concentrate in the leaves or bark of certain plants and indicate deposits below. The plants assimilate the metals as they take up nutrients from the soil, sometimes through extensive root systems that reach into bedrock. A significant concentration of a metal in a plant could signal the existence of a significant deposit underground.

Geologist Colin Dunn of the Geological Survey of Canada in Ottawa has found that the black spruce, a tree common in Canadian forests, concentrates gold and platinum in its outer bark and twigs. Uranium can also be found in its twigs, while arsenic—a "pathfinder" element that suggests gold is near—collects in its bark. Gold accumulates in the twigs of the alder as well.

Biogeochemistry could be a "simple and rapid and effective" alternative to conventional exploration techniques, asserts Dunn. Analyzing a plant for as many as 35 elements costs as little as \$10. Geophysical tests can run into the thousands of dollars.

There are other advan-

Biogeochemists sample the twigs of the black spruce to locate deposits of uranium, gold, and platinum.

tages. A chemical analysis of soil reveals only metals that don't dissolve in water. Groundwater washes away those that do. But plants absorb soluble metals along with the liquid. And while a heavy forest can hinder geologists searching for rock outcrops, biogeochemists use the trees themselves to find the gold, platinum, or other metal.

According to Dunn, the current trend "is to develop biogeochemistry as a regional exploration tool. You can scan an area very quickly." If a certain spot shows promise, more detailed biogeochemical, geochemical, and geophysical tests can be done.

He concedes that biogeochemistry has disadvantages. The amount of metal in plants varies with the seasons, often dropping too low to be meaningful in winter. Thus, geologists interested in the new approach "need to know much more about it before handing over a recipe to explorationists."

Bees and Bacteria

In fact, University of British Columbia geologist Harry Warren, an early pioneer of biogeochemistry, says mining companies are accepting the technique only "somewhat reluctantly." As early as the 1930s, he challenged five mining companies to allow a botanist with no knowledge of geology or mining to collect and analyze vegetation growing over mines. Warren says the test accurately identified zinc and copper mines, but he thinks companies resisted the technique because it was so new.

Now, mining companies are beginning to benefit from biogeochemistry, Warren feels. The approach has successfully located previously unknown areas of mineralization, such as a molybdenum deposit in British Columbia. At least two major Canadian Mining companies—Cominco and Placer are currently determining the commercial potential of some of the sites.

Dunn attributes the increased interest in biogeochemistry partially to more sophisticated analytical techniques. Since geologists look at the distribution of elements in the ground to pinpoint mineral sites, they need to analyze many samples. But new scientific instruments can rapidly assay a single sample of vegetation for a wide variety of elements simultaneously.

Warren has also begun using bees to aid biogeochemical prospecting. Platinum and gold concentrate in fireweed pollen, a favorite food of bees. So scientists analyze the pollen from hives placed near where fireweed grows. If they find signs of platinum or gold, they know those minerals are no more than a mile away, since that is the range that bees cover.

Microbiologist Glenda Michaels at Colorado's Western State College is taking a different approach to biogeochemistry, testing bacteria. The survival of microorganisms depends on developing resistance to local conditions, and around deposits of toxic metals like gold, silver, copper, and arsenic, immune strains will evolve. If a laboratory medium containing one of these poisons won't kill bacteria taken from a sample of soil or water, Michaels concludes that a valued mineral is nearby.

MICHAEL ROOT is a free-lance writer specializing in chemistry, biology, and the history of science and technology.

Radiation on the Job

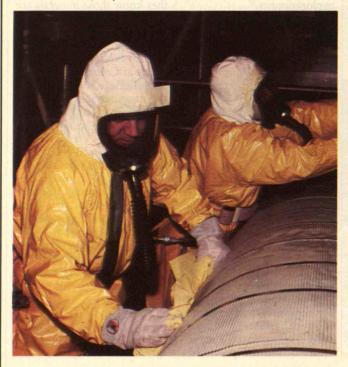
s nuclear power plants age, one of the most important concerns is protecting the people who troubleshoot coolant leaks and other breakdowns. A variety of critics say that these operations are exposing more and more repair workers to radiation. Public Citizen, a watchdog group founded by Ralph Nadar, charges that the number of exposed workers quadrupled from 1975 to 1985 although reactors on line only doubled.

Industry supporters counter that the average dose per employee is holding constant at .5 rem—a tenth of what the Nuclear Regulatory Commission (NRC) allows—and that few employees have exceeded the 5-rem yearly limit. Hal Peterson, senior health physicist in NRC's Office of Nuclear Regulation and Research, says this re-

flects efforts to cut exposures "as low as is reasonably achievable." A rem—"radiation equivalent in man"—measures radiation doses based on a substance's predicted biological effect.

The "hottest" nuclear plant repairs often crop up in steam-generator tubes, which can wear out and become highly radioactive. "Crud"—the industry's term for radioactive deposits—builds up inside the primary cooling pipes that run from the reactor into the generator. In the 1970s, crud buildup at the Dresden 1 reactor in Illinois became so severe that inspectors couldn't even examine the pipes, let alone repair or re-

Three Mile Island cleanup crews received lower radiation doses than expected. Personnel at other plants may be less fortunate.



MINI - TRENDS



PROP RETURN

The aircraft propeller is ready to stage a comeback. New materials and fabrication techniques allow the blades to be shaped for near-optimum aerodynamic efficiency. But unlike jet propulsion systems, propellers can't be enclosed to limit noise, so passengers probably won't accept them unless engineers can find a way to lower the noise level inside the cabins.

The propeller design has evolved from NASA's Aircraft Energy Efficiency program, which began in the mid-1970s in response to sharply rising fuel prices. Researchers from NASA and Lockheed are working to prove in flight what they have demonstrated analytically and in ground tests: that their reworked version of the propeller is a feasible alternative to higher-cost conventional jet propulsion systems. Propdriven planes could fly as fast as jets, yet researchers estimate that the new design could save airlines 15 to 30 percent a year in fuel costs.

VDT LAW

In May, the Suffolk County, N.Y., legislature passed the nation's first VDT workersafety bill, which could become a prototype for municipalities and states. Covering private businesses with 20 or more video display terminals, it mandates ergonomic furniture, special lighting, and detachable keyboards for workers who spend more than 26 hours per week using a VDT. Employers are required to cover 80 percent of the cost of employees' eye examinations and any necessary corrective lenses and frames.

The law will take effect in 1990. The measure was passed over the veto of county executive Patrick Halpin, who says several companies "told me bluntly they would either move from Suffolk County if this resolution became law or would not relocate here."

BEAR BREW

Late last year, 12 bears were seen cavorting at a fermenting corn pile near Essex, Mont., on the Flathead River. According to National Wildlife, the black and grizzly bears were indulging in their second annual pre-hibernation alcohol binge. "It smelled like a brewery," says Chris Servheen, grizzly-bear recovery coordinator for the U.S. Fish and Wildlife Service. "Six of us walked right up to a black bear that was scooping mouthfuls of corn with his paws. He didn't see or hear us."

The spree began in 1985, when a corn-laden train derailed, leaving 400 tons of corn beside the tracks. A year later, bears discovered the corn, which had fermented. Railroad crews dumped soil on the brew, but the bears returned last fall and dug up the



grain-alcohol cache.

This year, as bears emerge from their winter dens, authorities expect them to return to the site. "Bears are awfully hard to stop once they're on to something good," says Bart O'Gara from Montana's Cooperative Wildlife Research Unit.

CERTIFIED TECH

Representatives from 23 engineering societies met early this year in Atlanta to discuss initiating profession-wide specialty certification. As a result, engineers may follow in the footsteps of doctors, lawyers, and accountants. Proponents say certification could improve the profession's image and increase attention to quality service and public welfare.

Several sticky questions including legal issues, qualifications, and costs—have yet to be resolved. While the engineers supported certification in principle, they voted down a resolution that would have led to an organizing committee for an American Board of Engineering Specialties.

INSECT EATERS

Three Mexican scientists are pushing a nutrition idea they say is at least 450 years old: protein-rich tortilla flour made from the carcasses of insects. According to Pedro Valle and Julieta Ramos Elordoy of the Autonomous University of Mexico and Javier Cordoba of the Institute of Agricultural Research, the regular diet of Aztec emperors included more than 100 insect species.

With 40 percent of Mexico's 95 million people suffering from malnutrition, Elordoy says insect protein could quadruple the nutritive intake of average diets. For example, a pound of white ants or termites has 47 percent more food value than a pound of beef and 50 percent more than lentils or soybeans. Fly carcasses are 76 percent protein, followed by bedbugs (71 percent), grasshoppers (75 percent), and black beetles (68 percent). The researchers admit that insectbased foods face consumer resistance.—Joel Millman



place them. The reactor was shut down, and it remains closed.

In most cases, plant operators can flush coolant systems with solvent. But such decontamination is done by workers, who are often temporary employees hired by outside contractors. Public Citizen's Ken Bowley calls this a case of "body banking"-plant owners spread exposure over many workers rather than reduce the total amount of exposure per plant.

The "jumpers," as temporary workers are called, do the dirty work before more highly trained technicians take over, according to Stephanie Murphy of the Nuclear Information and Resource Service (NIRS). She says jumpers tend to be less well educated than their fellow workers and risk receiving high radiation doses by working at more than one plant.

Inside the industry, Tom Price of the Nuclear Management and Resources Council agrees that monitoring of jumpers is "not good enough." All reactor operators must submit a list of their workers to the NRC each year, but as Hal Peterson points out, the agency no longer tracks "multiple exposures" to people working more than a single plant. This situation may soon improve: the NRC plans to use computers to cross-analyze records from utilities, according to Peterson.

However, monitoring is only part of the problem. Jumpers as well as other workers are legally allowed to sustain exposures of more than 5 rems per year. In this arcane world, people can receive 3 rems per quarter-12 rems per year-if no individual exceeds a lifetime average of 5 rems per year. And the 12-rem limit applies only to external exposure. Regulations allow an additional 5 rems per year of internal exposure, for a grand total of 17 rems.

Moreover, some workers could receive twice the 17rem yearly limit since the badges that record doses need be only 50 percent accurate. And the location of the badges is crucial: they are usually worn on the upper torso, even though this part of the body remains outside the highly radioactive equipment workers often reach into during a typical repair. Thus, to increase protection, wearing more than one badge, especially near the hands, is becoming more common, says Peterson. He thinks "the chances of anyone getting a dose of even 5 rem year in and year out are slim," since the NRC would investigate.

No Standard for Standards

Critics maintain that the radiation standards are themselves arbitrary-and question why they are much higher for workers than for others. The NRC yearly dose limit for the public is .5 remsoon to drop to .1 according to regulations under final review. And the Environmental Protection Agency's standard for the public is four times as stringent as this revised limit.

Among many others, Kay Drey of NIRS thinks that new NRC standards for workers will boost exposure levels even further. Although a firm 5-rem yearly standard will replace the nebulous current limits, the dose calculations will change. Today, a rem value is determined for each isotope—such as strontium 90 or cobalt 60-based on its effect on a single critical organ. The new standards will average the dose to all affected organs. The result, says Drey, is that "permissible exposure levels" of some 65 percent of the radionuclides now regulated will increase. In other words, "more radiation will equal 1 rem."

Ironically, the relaxed dosages come just when new findings about victims of Hiroshima and Nagasaki are spurring many health physicists to call for stricter standards. And no one has comprehensively studied the health of workers at commercial nuclear plants. Northwestern University researchers began tracking cancer incidence at Commonwealth Edison of Illinois, the nation's largest generator of nuclear power, in 1983. But project director Joan Chmiel says the utility recently canceled the study because of inconclusive results: it's too soon to count excess cancers that may have been caused by the plant since the disease often takes years to appear.

Leonard Sagan, senior scientist for the Electric Power Research Institute (EPRI), is now organizing the first industry-wide look at radiation effects on reactor workers. Sagan says he wants to show that the industry is a safe place to work to counteract growing public anxiety about reported "cancer clusters" around reactors.

Whatever the outcome of EPRI's study, controversy will undoubtedly continue to dog nuclear power. As Chmiel points out, it's as difficult to prove the null hypothesis—that the radiation workers receive has no effect—as it is to clearly link exposure and disease.

SANDRA HACKMAN is a senior editor of Technology Review.

Banana Neurons

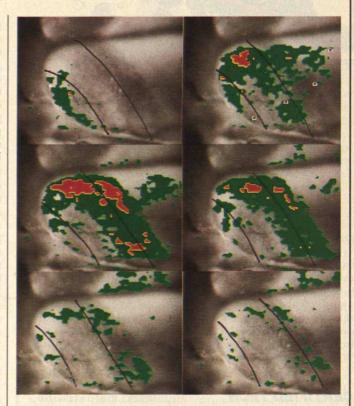
s a species, humans are so dependent upon vision that we often take our noses for granted. Because our sense of smell has historically been ignored by scientists as well, olfaction remains the least understood of our senses.

Yet smell has been of central importance throughout evolution. Not only do most animals rely on this sense for survival and mating, but most primitive life-forms are really pure "smellers"—chemical sensing devices. "Some very simple life-forms like protozoa might respond somewhat to light, but they are exquisite in responding to chemicals in their environment," says neurobiologist John Kauer of the New England Medical Center in Boston.

But what exactly is a "smell"? Researchers are baffled. Unlike light and sound, odor can't be easily characterized, and it is unclear what information the olfactory system is interpreting. Kauer notes the lack of "any nice, coherent, or intuitively obvious framework the way wavelength describes light or frequency describes tone."

Perhaps the greatest mystery is that of odor recognition. "When we smell bananas," Kauer asks rhetorically, "how is it that we can immediately recognize their scent? Does it mean that there is some grand banana neuron somewhere in our brain?"

The notion of a "banana neuron"—a nerve cell that reacts only to bananas—may sound farfetched, but that was essentially the working theory of olfaction just 20 years ago. The hypothesis



was that odorants were somehow matched with receptors much like keys to a lock. Although this theory hasn't been disproved, it appears impractical since it presupposes a virtually infinite number of highly specific receptors.

How Many Keys?

Today the analogy has switched to keys on a piano. A large but finite number of receptors, each corresponding to a key, could be "played" by particular pieces of molecules to produce a tremendously large variation of odor "chords." The important change is that researchers now think we identify a smell when a pattern of information comes into contact with many nerve cells. But how many keys does this piano have? Are there are ten different types of receptors or hundreds? By comparison, This sequence of video frames shows how an olfactory nerve changes when stimulated. The red spots are areas of highest activity.

two major types of receptors—rods and cones—take in all the information for vision

Kauer is trying to unravel such mysteries by studying olfactory neural networks, the clusters of nerve cells and their connections that allow us to smell. Using video cameras and image-enhancement techniques developed for satellite reconnaissance, he records what happens in a live salamander's olfactory bulb—the way station that initially processes odors. Kauer also employs a dve treatment developed by Yale University scientists. Treated nerve cells change color when they are stimulated by a given odor.

Kauer hopes that his research into the precise details of the salamander's olfactory system may lend more specific clues on how the brain encodes sensory information. A number of researchers have used the same kinds of techniques to demonstrate that one odorant-say, bananasexcites certain neurons, forming a distinct pattern. Moreover, a particular smell seems to excite a different pattern after repeated exposures. This suggests that in some way the neurons recognize information or even remember it.

Computing Smell

The interest in this forgotten sense has intensified because scientists are finding that this

sensory process can tell us more about neural processing in general, one of the fastestgrowing fields in biology. In fact, the physiological work by researchers like Kauer fits in neatly with theoretical work by many others. For example, computer scientists are trying to imitate neural networks to design parallel processors—systems that process information from many individual components simultaneously. Because smell recognition appears to result from a group of receptors working together, it is a good candidate for parallelprocessor modeling.

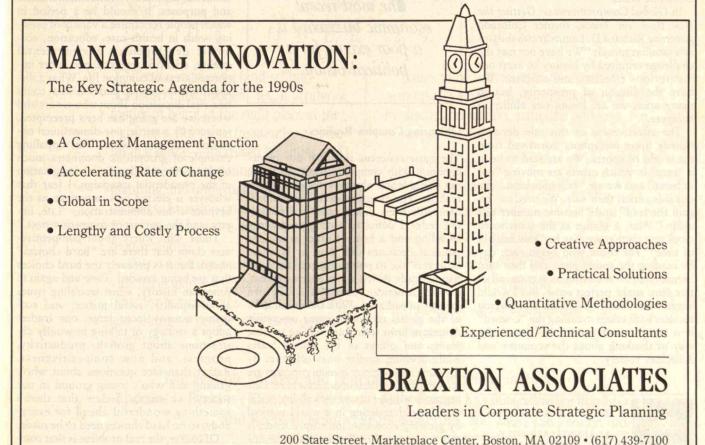
A collaboration between neurobiologist Gary Lynch and computer scientist Richof California at Irvine has produced one ingenious simulation. Lynch and Granger have designed a computer model based on the olfactory receptors of rats. Simulating individual odors as bar codes much like those used at the supermarket, the researchers have found that the cells closest to the entrance of the nose look for similarities between molecules. Cells further inside the nose tease out more subtle differences.

Meanwhile, at the Monell Chemical Sense Center of Philadelphia, olfactory scientist Charles Wysocki is charting the normal variation in what people can-and cannot-smell. He is studying "specific anosmias," the olard Granger at the University | factory equivalent of color | contributor to Trends.

blindness. Among his findings: as many as 45 percent of the subjects he has tested can't detect the musky odor of the chemical androstenone. Other people can smell this substance in concentrations as small as two parts per tril-

But despite the surge over the past few years, research into smell is still "almost virgin territory," according to Wysocki. "I used to say that olfactory science was pre-Galilean," he says. "Now there has been so much happening. Perhaps we may have moved up to a stage comparable to Galileo's time."

SETH SHULMAN is a regular



Let Them Eat Competitiveness

VERYWHERE I turn these days I hear word of a new gospel, an uplifting social purpose for America. Politicians of both parties, business leaders, university presidents, economists, and heads of research institutes and government agencies call for it. Countless speeches, articles, books, conferences, and news reports celebrate it. What is the name for our new national mission? "Competitiveness."

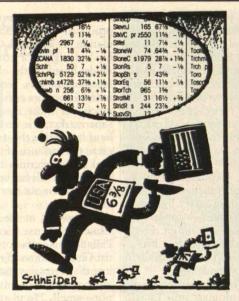
Here is how the story usually goes: Once upon a time, world markets in automobiles, steel, and electronics were "ours." But during the past two decades they have gradually been lost to foreign nations. More recently, deficits in the balance of trade have grown at alarming rates as have deficits in the federal budget. In a few short years, the United States has gone from being the world's largest creditor to being its largest debtor. The country is in danger of losing its supremacy in a wide variety of scientific, technological, and economic fields.

In Global Competitiveness: Getting the U.S. Back on Track, former Colorado governor Richard D. Lamm draws the story's familiar moral: "We have not met the challenge required by history to keep our institutions effective and efficient. We have the illusion of prosperity, but in many areas we are losing our ability to

compete."

The effectiveness of this tale depends heavily upon metaphors borrowed from the world of sports. We are said to be in a "race" in which others are moving "out in front" and we are "falling behind." It's our side versus their side. We need to "regain the lead" and "become number one again." Alas, a glance at the scoreboard clock reveals that we may be "running out of time." For those who begin each day by reading the sports page and then turn immediately to the business section, all of this must make perfect sense. But I would suggest that focusing on what Washington insiders have taken to calling the "c-word" is a narrow and potentially destructive way of thinking about the economy and American society.

LANGDON WINNER TEACHES IN THE PROGRAM ON SCIENCE AND TECHNOLOGY STUD-IES AT RENNSELAER POLY-TECHNIC INSTITUTE. HIS MOST RECENT BOOK IS THE WHALE AND THE REACTOR.



The most recent economic buzzword is a poor excuse for a political vision.

Obscuring Complex Realities

The basic concerns that fuel our preoccupation with competitiveness are valid, but the c-word obscures some complex realities. For example, declining national competitiveness didn't cause our mounting federal deficits; profligate defense spending and a host of other misguided political decisions did. And as Japanese observers like to point out, even the worrisome trade deficit is, to a great extent, owed by American companies to their own foreign subsidiaries. With the maturation of the global economy, many ostensibly American firms seem quite willing to close plants and offices in the United States while opening similar ones offshore. By the same token, many foreign concerns are busy expanding their operations here. One begins to wonder about the validity of nationalistic thundering in a world marked by growing economic interdependence. Is this "us-versus-them" script really the one we want to guide our actions?

The irony is that leaders who exhort the

public about declining competitiveness believe their theme is ultimately an inspiring one. If only the nation would face its economic plight squarely and make the hard choices needed to get "back on track," we'd face a happy, prosperous future. For ordinary working people, however, the underlying message is bound to seem largely negative. Although you are working hard and struggling to make ends meet, you are failing and may be obsolete. Those who control the nation's wealth and who provide your jobs may well decide to invest resources elsewhere. Far from a bold rallying call, the current barrage of competitiveness talk begins to sound like a not-so-thinly veiled threat. Our new C rations may not offer such an appetizing diet after all.

Reaffirming Primary Values

This is a time, an election year, in which the nation ought to be engaged in a debate about our democracy's fundamental ideals and purposes. It should be a period in which people reexamine a variety of pressing needs in health care, education, economic development, environmental quality, scientific research, and other important areas of common life. What a disappointment, then, to find that what could be a vital discussion about who we are and where we are going has been preempted, replaced by a sterile, one-dimensional obsession with the c-word. This appalling example of groupthink dominates much of the rhetoric and political imagination of the presidential campaign. I fear that whoever is elected may announce as the keynote of his administration: "Life, liberty, and the pursuit of competitiveness."

Those who worry about competitiveness claim that there are "hard choices" ahead. But it is precisely the hard choices that are being avoided. Time and again in American history, when troubling issues about equality, social justice, and economic security loom large, our leaders adopt a strategy of talking in woolly abstractions about growth, productivity, progress, and now competitiveness. Rather than face questions about who's gaining and who's losing ground in our society, we simply declare that there's something wonderful ahead for everybody, so no hard choices need to be made.

Of course, the real problem is that competitiveness in itself is simply not a pri-Continued on page 70



1988 FALL WORKSHOP

MARKETING MAKES THE DIFFERENCE

THE KEY TO THE
TOP AND BOTTOM LINES

OCTOBER 29, 1988

Effective marketing (and selling)
doesn't just happen. Yes, it is often a matter of being in the right place at the right time. But more frequently, successful marketing—increased revenues and market share—is a function of careful planning and implementation. This includes: Focusing on customer benefits, customer service and customer requirements.

This workshop was designed to provide participants with practical suggestions for tactical and strategic marketing and selling by people who have done it successfully.

Issues to be addressed at the Ninth Annual MIT Enterprise Forum Workshop by discussion leaders, panelists and keynote speakers include:

- —The customer
- -Market research
- —Competitive analysis
- —Pricing and positioning
- -Advertising and sales promotion
- —International distribution
- —Training of sales professionals
- —Closing the sale

The keynote speaker and general session panelists include: Thomas J. Perkins (Kleiner & Perkins); Sally Frame-Kasaks (Talbots, Inc.) and Regis McKenna (Regis McKenna, Inc.)

Is There Light at the End of the Tunnel?

THE U.S. economy is caught in a growth tunnel. Between 1985 and 1987, the annual economic growth rate, correcting for inflation, hovered in the neighborhood of 3 percent. If current forecasts are to be believed, the story will be the same for 1988 and into 1989. Never since GNP data have been calculated has the economy grown at so steady a rate for so many years. In fact, the U.S. economy is famous for just the opposite—its extraordinary volatility, roaring off into booms and then crashing into recessions or depressions. What explains this newfound stability?

Imports create the ceiling of the growth tunnel. Americans have a high propensity to spend additional income on foreign goods. But the more we spend on imports, the less we contribute to increased demand for domestic products, more American jobs and income, and another round of

economic growth.

Quite the contrary, a strong demand for imports leads to ever larger trade deficits that become harder and harder to finance. To borrow the foreign funds necessary to finance foreign purchases, interest rates must rise. But high interest rates turn off domestic economic expansion. As a result, the U.S. has difficulty growing at a rate of more than 3 percent.

Debt problems determine the floor of the tunnel. If economic growth were to fall much below 2 percent, many debtors would be unable to make their interest payments and defaults would mount rapidly. For example, in the absence of at least some U.S. growth, Latin America would default, putting major U.S. money-center

banks in deep trouble.

Already, thousands of U.S. savings-andloans institutions are technically bankrupt because of their "negative net equity": if they were liquidated, they would be unable to pay off all their depositors. Growth rates below 2 percent would mean negative cash flows as well. Borrowers would be unable to service their debts, forcing the savings and loans to close.

To avoid hostile takeovers, many corporations have substantially increased



Economic realities
are relegating the economy
to steady but slow
growth.

their ratio of debt to equity, borrowing as much as they possibly can. They can barely make the necessary interest payments with a 3 percent growth rate. Any slower growth—for example a repeat of the 1981-82 recession—would cause far more firms to go broke this time than did six years ago.

Preventing a Finanical Disaster

Put bluntly, to prevent a financial disaster the fiscal and monetary authorities must avoid slow or negative growth at all costs. The last accidental recession in the United States was that of 1960-61. Each and every one since then has been started deliberately to brake the economy and stop inflation. True, some did not occur precisely when policymakers desired. For instance, the Carter administration wanted to create a recession in 1979, but it took place in 1980, an election year. Other planned recessions, such as that of 1981-82, have simply got out of hand. Still, to a large extent policymakers can decide whether the country will have a recession

or not. And given the current debt situation, no American government is going to cause another in the foreseeable future. The resulting financial and industrial bankruptcies would simply be too widespread to tolerate.

Instead, the Federal Reserve Board will print money, cut interest rates, and do whatever else it must to insure that the growth rate does not slip below the 2 percent limit. If necessary, monetary policies will be reinforced by fiscal stimulus. In effect, government macro-economic policymakers are in a debtor's prison where they have little freedom to maneuver.

Looking ahead, what factors might break the U.S. economy out of its growth tunnel? There are at least two scenarios, one negative and one positive. A cessation of foreign investment could cause a recession whether U.S. financial policymakers like it or not. In 1987, foreign savings financed 22 percent of America's investment. If those foreign funds stopped flowing, interest rates would have to soar to squeeze 22 percent of the borrowers out of the capital markets. Investment would plunge and the resulting recession would be difficult to offset.

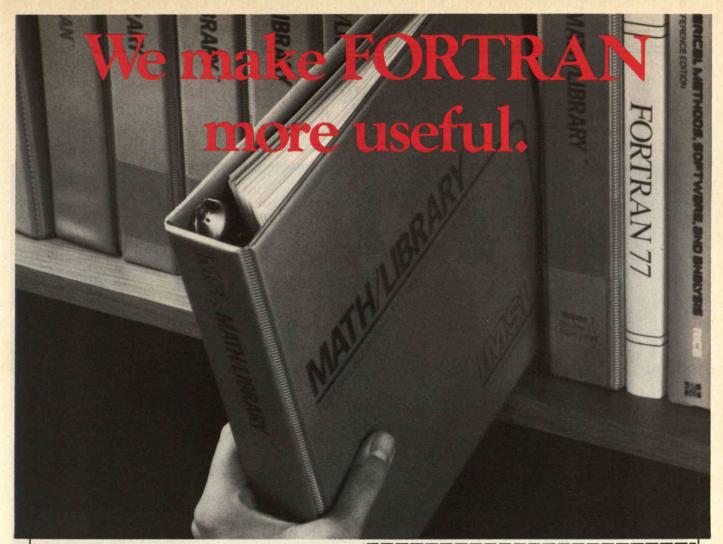
On the other hand, U.S. exports might take off because of the low-valued dollar. If they do, the U.S. economy could have a full-fledged export boom for the first time since World War II.

In the immediate future, neither scenario looks likely. Foreign central banks continue to provide funds for the U.S. capital market for the simple reason that doing so helps them preserve jobs at home. Investment in the U.S. economy spurs economic growth, which fuels the demand for foreign goods and adds to the trade surplus of foreign countries with the United States. And while U.S. exports have improved slowly, they have had only minor impact on the balance of payments. As a consequence, the American economy is likely to remain in its tunnel.

Three percent annual growth is neither the "best" nor the "worst" of times. However, this stability paradoxically leads to uncertainty in the financial markets, because everyone understands that the tunnel cannot go on forever but no one knows when it will end. And when the end finally does come, will the floor collapse or will the ceiling open up? Living with that unanswered question makes everyone nervous, despite the fact that day-to-day events are OK.



ECONOMIST LESTER C. THUROW IS DEAN OF THE SLOAN SCHOOL OF MAN-AGEMENT AT M.I.T.



Comprehensive Mathematical and Statistical Subroutines Within Your Reach

If you use FORTRAN as a problem-solving tool, IMSL software libraries should be right at your fingertips. Leading the field of numerical software, these libraries provide a comprehensive source for mathematical and statistical FORTRAN subroutines.

Calling a single subroutine could save you the seemingly endless effort spent developing and debugging code for your FORTRAN application programs. IMSL libraries not only increase productivity, but can actually enhance the accuracy and robustness of your scientific and engineering programs.

These libraries comprise over 800 proven subroutines supported on more than 40 computing environments ranging from personal computers to supercomputers.

For more than 18 years IMSL has maintained a reputation of excellence and today it serves more than 8000 clients within major corporations, universities, and research centers around the world.

Contact us today and let us tell you how we can make FORTRAN more useful for you. Call toll-free 1-800-222-IMSL; in Texas or outside the U.S., call (713) 782-6060.

Copyright © 1988 by IMSL, Inc. All Rights Reserved.

Call 1-800-222-IMSL or mark the boxes below for information about any of IMSL's libraries of FORTRAN subprograms and return to: IMSL Inc., Marketing Services Division, 2500 ParkWest Tower One, 2500 CityWest Boulevard, Houston, Texas 77042, U.S.A.

- ☐ MATH/LIBRARY—More than 400 mathematical subroutines
- ☐ SFUN/LIBRARY—Subprograms for evaluating special functions
- ☐ STAT/LIBRARY—Over 350 statistical subroutines

Name Title

Organization

Department

Address

City/State/Country Postal Code

(Area Code) Phone Telex or Fax

Computer Type Operating System

Problem-Solving Software Systems

TECH8808

FORUM

BY ROBERT B. REICH

Teaching to Win in the New Economy



THE American system of public education has long resembled the mass-production factory for which schools prepare the young. Students proceed along an assembly line of sequenced grades. At each stage teachers fill students' heads with standardized information. As in a mass-production line, students are sorted according to their capacities. While most are trained for repetitive jobs, few are trained to act as decision makers.

But such standardized methods of education cannot teach everyone the skills necessary to respond to today's changing economic system. In a world where billions of potential workers are ready to underbid American labor, the U.S. competitive advantage must shift from standardized production toward work whose value is based on quality, flexibility, precision, and specialization. No small group of decision makers at the top can keep up with all the variations that meet different

responsibility and collaboration.

customers' particular needs. Much relevant information lies below—amon

The success

of our future

economy depends

on all students learning

customers' particular needs. Much relevant information lies below—among workers in direct contact with suppliers, production processes, and customers.

If managers are to create environments in which all workers can identify and solve

in which all workers can identify and solve problems—and if the entire work force is to be capable of developing small-scale innovations quickly—we need a fundamentally different philosophy of education. At the least, we must help all our children become minimally literate and numerate so that they can learn throughout their lifetimes. We also must prepare our children for jobs involving responsibility and collaboration.

A higher proportion of our young people are better prepared for productive lives than ever before. Over 86 percent of U.S. adults in their twenties have completed high school, twice the percentage in 1940. And a quarter of our young adults have finished four years of college, up from 12 percent in 1960. Still, the worst-prepared third of young Americans—disproportionately lower-income—are almost to tally unprepared. They cannot do simple calculations, understand written directions, or read road signs, charts, and maps.

These deficiencies are starting to affect American business. When New York Telephone Co., a NYNEX subsidiary, undertook a large-scale recruiting effort in 1987, it found that more than 80 percent of its New York City applicants failed entry-level examinations in basic reading and reasoning skills. All told, one of three U.S. corporations now provides some form of basic-skills training for employees. The American Society for Training and Development Study predicts that industry will soon have to spend as much as \$25 billion yearly on remedial education.

We have to increase our educational efforts to reach people lacking basic skills, particularly since the number of poor peo-

ROBERT B. REICH, who teaches political economy and management at Harvard University's Kennedy School of Government, is author of Tales of a New America (Viking paperback, 1987) and editor and co-author of The Power of Public Ideas (Ballinger, 1988).

ILLUSTRATION: KEVIN HAWKES

ple is increasing. Some 22 percent of our children are now born into poverty, up from 15 percent in 1970.

Perhaps more members of this group will receive better training as recent educational reforms, including stricter promotion and graduation requirements, take hold. But ironically, these very changes may prompt some of the neediest students to drop out.

And in any event, formal schooling may come too late in the lives of many children, since learning habits and attitudes are firmly established before kindergarten. Studies point to the importance of early education, beginning with toddlers. (See "Educating More Minority Engineers," July 1988.) The next wave of educational reform surely has to concentrate on developing learning habits and basic skills in children aged 2 through 10.

Students Take Initiative

The other part of the challenge is to stop training the majority of our young people for jobs in which they work like cogs in a wheel. If our future workers are to implement continuous improvements in products and processes, every student must be educated to think critically and continually learn based on new information.

Teachers must allow and encourage students to take more initiative in deciding what they learn, and when and how they learn it. Rather than assuming that others generate problems, students should learn that they can have an active role in devising problems. Young people should also experiment with solving problems and thus discover underlying principles that help define and solve related problems.

Teachers should help students realize that this approach will help them through their careers. As Shoshona Zuboff of Harvard Business School vividly shows in her new book *In the Age of the Smart Machine*, people who work with computers have to be able to analyze the enormous quantity of information available. Then they have to be capable of applying their knowledge to any of a number of work-related problems.

It will not be easy to turn around an education system so strongly directed toward content rather than process. The cost of changing the system will be high. Schools' middle-level managers—such as deputy superintendents—will feel threatened if responsibility is pushed down to

teachers and students. And society will have to overcome its inclination to focus on the facts children are learning.

But the habits and techniques of experimentation 'are critical in an economy in which technologies, tastes, and markets are in constant flux. Such an environment requires informal, on-the-job education as well as continual retraining. A work force that has been taught enthusiasm for learning and experimentation will take responsibility for such lifelong education.

Learning to Collaborate

Specialized skills are also important, of course. More young people will have to be able to communicate in foreign languages and gain a working knowledge of other cultures. More will need advanced education in math, science, and engineering, and the ability to cross disciplines.

Our culture has never had much difficulty teaching such intellectual tasks to the most talented and fortunate fifth of our young people. The challenge is to distribute the individual talents and specialized skills broadly, by encouraging people to work together.

If our business enterprises are to be flexible and innovative at all levels, youngsters must be prepared to work with and through large numbers of people. While there will always be a need for some solo practitioners, the more usual requirement will be for combinations of individual skills. Most of the important work will be done by groups rather than individual experts. Consider how the development of most computer systems requires highly interactive groups of knowledgeable workers. Similarly, the number of people coauthoring scientific papers has increased dramatically in recent years. In 1986, 75 people co-authored a paper with evidence related to the location of the gene for Duchenne muscular dystrophy.

Learning to collaborate suggests a different kind of education than one designed to prepare relatively few young people to become experts. Instead of emphasizing quiet and solitary performance of specialized tasks, teachers should place more emphasis on communication within groups as they define and solve problems. Students should learn how to share what they understand, and to build upon one another's insights. Pupils need to understand the importance of seeking and accepting criticism from peers, soliciting help, and giv-

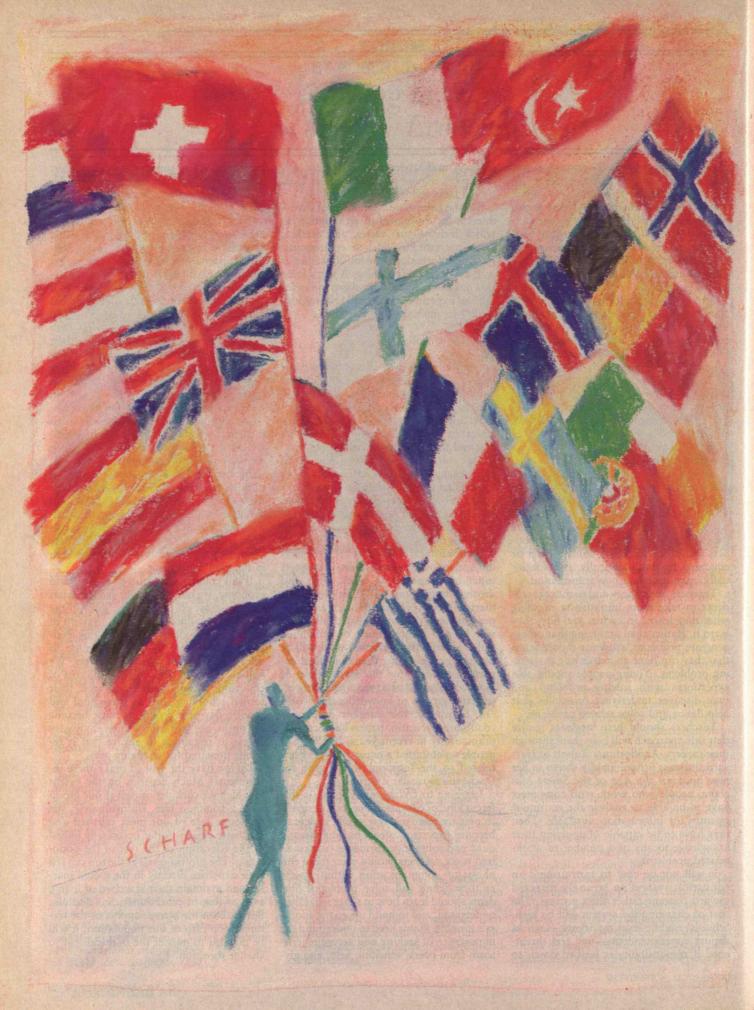
ing credit when appropriate. They must also learn to negotiate—to articulate their needs, discern what others need, and discover mutually beneficial outcomes.

The "tracking" system, by which students are grouped according to the speed of their learning, can reduce young people's capacities to learn from, teach, and collaborate with one another. With the exception of learning-disabled children who need special attention, all children should remain together. Faster learners would learn how to help the slower, while slower ones would be motivated to make their best effort. Rewards for effective teaching and learning should go to both. And the slower learners should have opportunities to teach younger children.

Some observers suggest that the teamwork approach in Japanese schools helps explain that country's low rates of absenteeism on the job and its companies' quick responsiveness to new opportunities. But don't the Japanese run a severe risk of mistaking conformity for collaboration? Yes—so we must encourage individual creativity while teaching the art of working together. We cannot emphasize collaboration to the point that we recreate the stifling 1950s atmosphere of the man in the gray-flannel suit.

If this country is to succeed in the world economy, we must do in our schools what we also must do in business: give up the model of mass production for a system of quality and flexibility. Meeting this challange will require that we pay more to attract and retrain talented teachers. We will also have to bear more of the cost of educating citizens before and after their formal schooling. Just as pre-school and toddler day-care programs must become the norm, our work force must enjoy easy access to retraining to ensure that it remains prepared for changing jobs.

Do we have the will to make these investments? Much depends on the extent to which we consider ourselves one group with a common fate. Unfortunately, the economic fate of our most talented and fortunate citizens is not necessarily linked to the education of the rest of the population. The professionals at the top can sell their expertise directly in the global market and maintain their standard of living, even as that of other Americans declines. But without the active support of the fortunate top fifth of our population, it will be difficult to muster the political will to change direction.



A vill parter and Rad Rad Land Address A village A villa

Through an innovative
19-country program, Europe finds a way to
stimulate cooperative R&D, forge industrial
alliances, and bring new technologies
to the market.

UROPE's high-technology companies have long argued that they would stand a better chance against their U.S. and Japanese competitors if they were allowed to cooperate more freely across national boundaries. That way they could share costs, avoid duplicating research efforts, and possibly exploit a single European market. But so far attempts at collaboration have all too often been limited to major science projects such as space launchers and experimental nuclear reactors. A mountain of protectionist trade practices, restrictive customs regulations, and conflicting national technical standards has stymied the rest.

During the past three years, 19 European countries have taken steps to change this situation. They have established a formal joint program known as EUREKA—the word Archimedes is said to have exclaimed when he conceived the idea of specific gravity while lying in his bath. EUREKA has already brought together scientists and engineers from over 600 industrial companies and public research institutions in more than 165 R&D projects. The total budget for EUREKA-sponsored research is about \$5 billion, split

roughly equally between public and private funds.

EUREKA's projects cover a broad spectrum of technologies and

applications. Among the largest are:

PROMETHEUS (or Program for European Traffic with Highest Efficiency and Unprecedented Safety), an eight-year, \$68 million effort to develop technologies for computer-aided driving. The system would use "intelligent cars" and electronic trafficflow monitors to increase communication among drivers and automatically detect any risk of collision. Twenty of Europe's leading car manufacturers, including Fiat, Volvo, Renault, and Daimler Benz, back the project.

☐ FAMOS (an acronym drawn from the German expression for "flexible automated assembly systems"), a \$160 million initiative to integrate advanced technologies into a range of manufacturing and assembly systems. FAMOS will target aerospace, automobiles, pharmaceuticals, electronics, textiles, composite materials, and a wide range of other industries.

☐ EUROLASER, a five-year, \$47 million program to develop and evaluate the industrial uses of highpower lasers. This venture, involving companies and research institutions from five countries, will focus on installing or upgrading high-power laser facilities—including the equipment needed to manipulate beams and measure their characteristics.

COSINE, a government-initiated project, now supported by all the EUREKA signatories, to establish a Europe-wide communications network. The system would link up the large computers used by researchers in universities and the private sector.

Developing Marketable Products

EUREKA's chief goal is to encourage what is known as "competitive research"—efforts that help develop marketable products and processes incorporating advanced technologies. This distinguishes it from other European joint research efforts—for example, the European Economic Community (EEC) ESPRIT project in information technology and RACE project in communications technology. These programs concentrate on "pre-competitive" research—which is of general value to a broad range of companies but not leading to specific products.

One EUREKA initiative unites research workers

from the French water utility. La Lyonnaise des Eaux, and the Danish company, De Danske Sukkerfabrikker, to produce porous plastic tubes that filter unwanted chemicals, bacteria, and particles out of drinking water. Dirty water is run through the tubes and the pores hold back the impurities. Based on studies carried out primarily at France's National Center for Scientific Research over more than 20 years, this method is not only cheaper than traditional filters that use chemicals or mineral sands, but the quality of the treated water is better. According to Lyonnaise research director François Fiessinger, the new plastic technology promises a "revolution" in water purification procedures. It will be widely marketed to utilities in Europe and throughout the

world, including the United States.

EUREKA also has broader strategic aims. For the goverments involved, it symbolizes a new political willingness in Europe to cooperate in the high-technology fields on which future prosperity is likely to depend. The European Economic Community sees the program as one part of the broad effort to eliminate all barriers between member states by 1992. For instance, joint participation in EUREKA projects could lead to common technical norms in key advanced technologies and consumer products. This alone would represent an important first step toward creating a single European domestic market that would be large enough to serve as a springboard for competing in other parts of the world. For the companies involved in EUREKA, which include some of Europe's leading technology corporations, the program is also a mechanism to create the industrial alliances necessary to compete on a global scale.

A Civilian SDI

The idea of EUREKA was first proposed by French president François Mitterrand. In 1985, Mitterrand recommended creating a European Research Coordinating Agency to sponsor technologies in which Europe is in danger of lagging behind the United States and Japan. Ever since he came to power in 1981, he had been seeking ways to encourage greater European collaboration in high technology. But the specific technologies Mitterrand targeted in his 1985 speech suggested a particular political purpose. Supercomputers, artificial intelligence, large-scale lasers, and "opto-electronics"—computers that transmit signals by light rather than by electric im-

DAVID DICKSON is European correspondent for Science magazine. His book The New Politics of Science was recently published in paperback by the University of Chicago Press.



pulses—were all high priorities of the U.S. Strategic Defense Initiative (SDI), in which European scientists had recently been invited to participate. For Mitterrand, a European alternative to SDI would make sure that European advanced research would not come to depend on the priorities of the U.S. government and U.S. private industry.

Some European political leaders supported Mitter-rand's idea, in particular the West German foreign minister Hans-Dietrich Genscher, who was convinced that such an agency could accelerate the political integration of Western Europe, reduce its dependence on the United States

for advanced technology, and increase its voice in world affairs. But others, in particular officials of the British government, were far more skeptical.

According to the critics, the original French proposal had two shortcomings. Although it was ostensibly intended to develop commercial technologies, crucial decisions about R&D were left in the hands of government-appointed committees, who were unlikely to respond flexibly to private markets. Second, at a time when political trends throughout Europe were favoring stringent fiscal restraint, initial proposals for EUREKA appeared to call for large-scale public funding.

Such criticisms persuaded Mitterrand that without substantive changes, his proposal would not be accepted. Therefore, he gave up the idea of creating a brand new agency to coordinate technological research and decided that EUREKA should stimulate links among existing R&D teams at companies and research institutions. And because a marketable product or process was the goal of each EUREKA project, major research decisions were left to the private sector. Once this new formula had been established, endorsement from European nations snowballed. By December 1986, 19 countries had

uropean
collaboration has traditionally
been stymied by protectionism,
restrictive customs
regulations, and
conflicting technical
standards.

formally agreed to participate.

How EUREKA Works

EUREKA's private-sector focus and emphasis on marketable technologies have resulted in a highly decentralized structure. "EU-REKA is basically a bottomup approach," explains Bernhard Rami of the project's small staff in Brussels. "It's open to all appropriate organizations such as businesses, universities, and specialized research institutions, irrespective of their structure or dimension."

When researchers from two or more participating countries have agreed on an outline for a joint proj-

ect, they submit a proposal to their respective governments. If approved, the proposal is forwarded to the research ministers from all the nations participating in EUREKA, who are responsible for final endorsement. Details of the project are also circulated among the member states, to see if any other institutions are interested in joining. However, the researchers do not have to accept all interested parties into the project.

Once a project is accepted into EUREKA, financial support can come from two principal sources: the individual companies backing the project or government-funded programs to encourage industrial innovation. Some projects are also backed by money that banks and other financial institutions have invested.

Public funding explicitly earmarked for EUREKA is relatively small, representing less than 10 percent of the \$5 billion total budget. Most government grants made available for EUREKA projects, particularly in Britain, France, and West Germany, are funds that had already been set aside to stimulate industrial innovation.

Even so, government endorsement of EUREKA projects does have a substantial indirect advantage. Of-



ompanies
participating in EUREKA
retain all rights
to any technology
developed.

ficial approval often makes it easier for firms to raise private financing. The EUREKA charter formally commits a government to step in if a project encounters bureaucratic obstacles—such as customs barriers that inhibit moving high-tech research equipment, or problems getting the results of safety tests accepted in different countries. "Our project would probably have started anyway, but it would have been much more difficult to raise the money," says Frederic Dufau of the chemical engineering division of Bertin and Cie., a French firm working with labs in France and Switzerland to produce special chemicals by cell-culture techniques. "Because time is at a premium, EUREKA has been very important to us."

Once a project is under way, control remains decentralized no matter how many government subsidies are involved. For example, the FAMOS project on flexible automation was initially proposed by a group of French and German industry and government officials in October 1985. It is now supported by 15 different European nations, each of which has nominated one member of a central steering committee. In addition, the program has a small staff based in West Germany. Ideas for specific FAMOS initiatives, however, come from companies and research groups within the individual countries.

Over 100 such proposals have already been received and so far, the FAMOS steering committee has approved 16. These include an Italian-led project on the automated assembly of refrigerator compressors and one from France on a high-performance assembly line for low-voltage industrial circuit breakers.

The West German engineering company Robert Bosch, working with the Italian company B. Ticino, is constructing a pilot plant in which components for automated manufacturing systems will be assembled by robots.

In every EUREKA project, the participating companies retain all rights to any technology developed. When companies agree to collaborate on a project, they usually agree to a marketing alliance as well, which means that collaboration should continue beyond the laboratory. In the largest EUREKA projects, including PROMETHEUS, members expect to form consortia that will compete with one another to provide the new technologies to European and world markets.

Too Important to Leave to the Private Sector?

One sign of EUREKA's success is the large number of non-government organizations that have provided enthusiastic endorsement. Both the European Bankers' Roundtable and the European Venture Capital Association support the program on the grounds that closer international cooperation is likely to make their investments in high-tech companies more effective. The European Federation of Trade Unions also supports EUREKA, arguing that a coordinated European technology strategy is needed to maintain high levels of employment.

However, controversy remains about how EUREKA is likely to develop in the future. One issue is the program's relationship to military technologies—and, more broadly, to the defense research strategies of individual member countries.

The formal purposes of EUREKA are strictly civilian—a necessary quid pro quo for membership of neutral European countries such as Sweden and Austria. West Germany, for example, while supporting EUREKA as a mechanism for European unity, has played down any potential parallels with the SDI program. And government officials throughout Europe tend to avoid discussing the military potential of EUREKA-supported technologies, largely for political reasons.

Nevertheless, many of the technologies developed under EUREKA will eventually find military uses. For example, one project, known as EUROFAR, is designing a European version of an aircraft with rotors on the end of each wing. The rotors swivel 90 degrees, allowing the craft to take off like a helicopter but

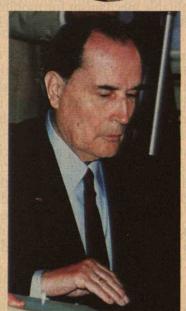
French president François Mitterrand (bottom) first proposed the EUREKA concept in 1985. While some European leaders such as **West German for**eign minister **Hans-Dietrich** Genscher (top) supported Mitterrand's original proposal, it was the critics, par-ticularly officials under British prime minister Margaret Thatcher (middle), who most influenced **EUREKA's final** form.



■ EUREKA Participants

Austria Belgium Denmark **Finland France** Greece Iceland Ireland Italy Luxembourg **Netherlands** Norway **Portugal** Spain Sweden Switzerland Turkey United Kingdom **West Germany**







Started

The FAMOS project is one of EUREKA's largest. Governments and firms from 15 countries are investing \$160 million to integrate advanced technologies into a wide range of production systems.









NATIONS URGED TO JOIN THE ORGANISATION NOW

subsequently fly like a conventional turboprop.

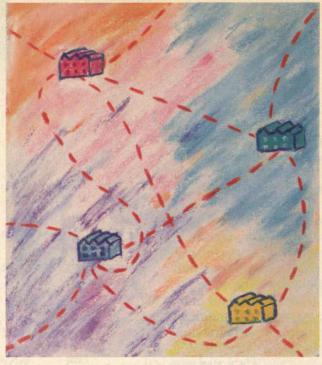
The six European companies involved in EUROare primarily FAR interested in meeting future demand in the civilian market-for example, flying passengers in and out of city centers. However, they have their eyes on the large potential military market as well, since the aircraft could be used for anti-submarine warfare or tasks such as moving troops into remote battle areas.

It is difficult to know how the overlap between civilian and military applications will be resolved. One possibility is that a

parallel military version of EUREKA might be created for those countries and firms willing to participate.

Another controversial issue is whether Eastern European countries, companies, and research institutions should be allowed to participate in EUREKA projects. Officials from Bulgaria, East Germany, Hungary, and Yugoslavia have expressed an interest. And some Western European politicians seem open to the Eastern bloc's involvement. West German foreign minister Genscher has said that he feels such participation "should not be excluded" if the Western states want to avoid "a technological fragmentation of Europe." Already, a Hungarian environmental research institute has been proposed for inclusion in a project on European pollution, and Yugoslavia has applied for membership in COSINE, the project to create a Europe-wide computer network.

However, while Eureka members generally don't object to specific Eastern-bloc research institutions' participating in individual projects, most are against involving Eastern European governments as full signatories of the Eureka accord. Some of the reasons are pragmatic—for instance, the concern that socialist economies, with their large state enterprises and different systems of patent law, lack the market-oriented structures through which Eureka is in-



UREKA serves as a mechanism for integrating European industry.

tended to operate.

Other objections are political. EUREKA's member governments want to maintain control over the pace of technology transfer between the two blocs, and they are especially interested in keeping an eye on advanced technologies that might eventually end up in Soviet weapons. Deciding Eastern European participation on a case-bycase basis allows Western European governments to slowly expand technology transfer even as they keep political control over the process.

There is some concern among EUREKA's member countries that the main be-

neficiaries of the project so far have been the larger multinational corporations who already have an active tradition of international cooperation. Government officials responsible for EUREKA are now making special efforts to encourage greater participation by small and medium-size enterprises. Ideally, EUREKA could be a valuable mechanism for mobilizing human and technological resources for these firms.

Finally, some observers feel that while the idea of European cooperation on R&D is a good one, the current structure and organization of EUREKA raises important political questions for Western Europe itself. In a report to the research and technology committee of the European Parliament, British member Glyn Ford argues that Europe needs to base its technology strategy on political rather than market criteria. Like other critics, Ford thinks relying on the private sector alone precludes coherent strategic decisions about which technologies to favor. He recommends that EUREKA's member governments and the EEC itself play a much more active role in determining which R&D projects receive funding.

Ford also objects to the fact that countries not involved in a specific EUREKA project have no access to the innovations that come out of it. As a result, he says, smaller nations able to take part in only a

limited number of projects derive "little apparent advantage" from the program. In contrast, all EEC countries have access to the results from the EEC's own joint research programs, such as the ESPRIT project in information technology, no matter what the nationality of the scientists doing the research.

But if Ford maintains that technology is too important to leave to the private sector, EUREKA supporters claim precisely the opposite—that technology is too important to leave to governments. From this perspective, EUREKA's flexibility and decentralization are its main strengths, since they allow the companies themselves to discover areas where cooperation across international boundaries makes economic sense. If there is any political agenda, EUREKA advocates argue, it is to persuade governments to support the market-driven efforts of Europe's high-tech companies.

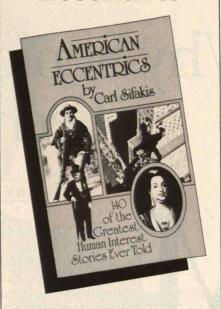
The Politics of European Unity

The amount of money involved in EUREKA projects is small compared with overall levels of R&D funding by European governments and corporations. And it may turn out that collaboration among European firms will prove less important economically than collaboration between these firms and corporations in the United States or Japan. But the true significance of EUREKA is as a crucial institutional mechanism for the broad reorganization of European industry—integrating research, development, and marketing and creating a single European market by 1992.

Obviously, the social implications of this reorganization will be enormous. While some industries, nations, and regions will be winners, there will be losers as well. How will the changes affect employment? Will new industries expand rapidly enough to absorb jobs lost in industries that do not benefit from EUREKA-inspired technologies? How can nations or communities avoid damaging conflicts over who profits from European integration?

Because EUREKA has been presented as a program for technological—as opposed to political—collaboration, such questions have received relatively little attention. And yet they remain important. In less than three years, EUREKA has established itself as one of the central features in Europe's new technological landscape. What it means for Europe's political landscape remains to be seen.

A Feast of Fabulous Eccentrics



AMERICAN ECCENTRICS

140 OF THE GREATEST HUMAN INTEREST STORIES EVER TOLD CARL SIFAKIS

140 entertaining sketches of some of America's most outlandish individualists. True tales of fantastic misers, recluses, imposters and many more wild eccentrics provide hours of delightful reading.

PLEASE SEND ME _____ COPIES OF AMERICAN ECCENTRICS AT \$8.95 EACH, PLUS \$1.50 SHIPPING

CHECK ENCLOSED FOR ______TOTAL

☐ CHARGE MY: ☐ MASTERCARD ☐ VISA

CARD NUMBER _____EXPIRATION DATE _____

SIGNATURE _____SHIP ORDER TO:

NAME _____ADDRESS _____

STATE

MAIL TO: TECHNOLOGY REVIEW, DEPT. FB87 ROOM 10-140 MIT, CAMBRIDGE, MA 02139



Technology can help make up for what age takes away, but getting seniors to accept it—and Medicare to pay for it—is a different matter.

Why Seniors Don't Use Technology

BY FRANK BOWE

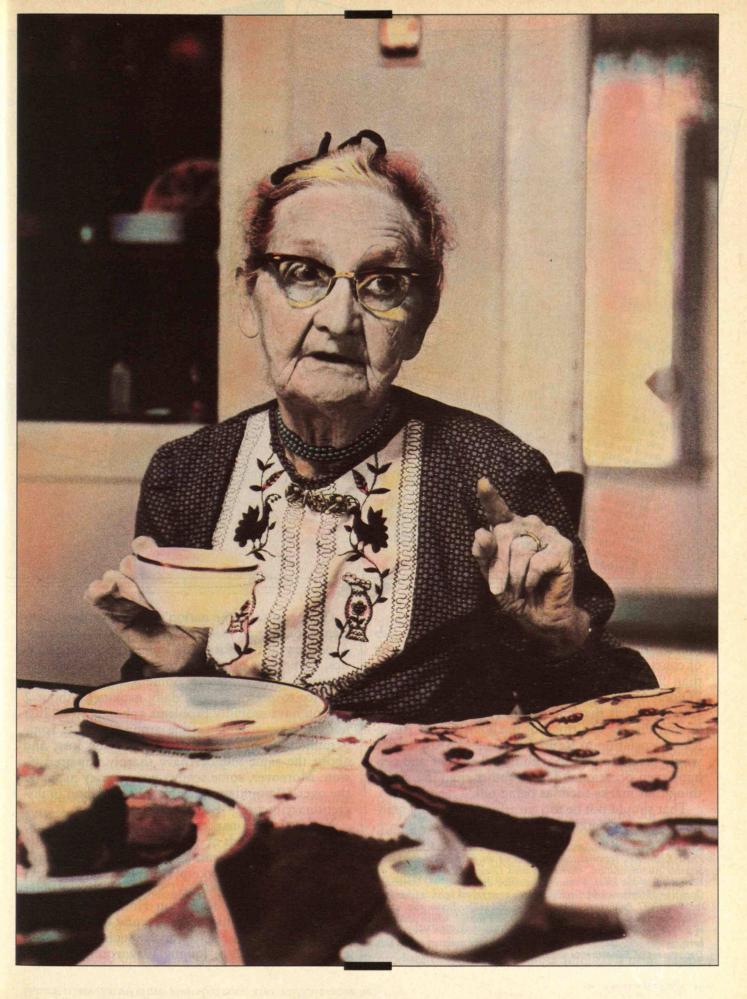
y mother, who is 66, lives on her own in Lewisburg, Pa. Since her stroke five years ago, her life has been increasingly isolated and difficult. She can no longer drive. Walking is painfully slow, even with a cane, and she is reluctant to use her wheelchair. Thus she seldom leaves the house. Even at home she has trouble getting around. It usually takes six or eight rings before she can answer the telephone, by which time many callers have hung up. Just standing up to turn off the light is a chore for her. She's also gradually losing her hearing; television is her main source of entertainment, but she's finding it harder to understand the words.

I keep telling her there are plenty of products that could make her life easier. A home-control system that activates electronic devices remotely would enable her to turn out the porch light and lock the front door at night simply by speaking a few words. If she found herself nodding off while watching the late movie, another device could enable her to clap her hands and turn off both the TV and the bedroom lights. She could answer the phone by shouting "phone!" from a different room; or, if she forgot a number, she could just say "call Stephanie" and the phone would dial itself. To make television more enjoyable, a "closed captioning" decoder attached to her set could provide subtitles for her favorite shows.

Common products could also help her feel more secure about her health and well-being. Her pillbox could sound an alarm whenever it was time for her medication, resetting itself automatically for the next dose. And if she fell and broke her hip, something she worries about a lot, she could summon assistance from those she most trusted by pressing a button on a transmitter in her pocket. It would automatically dial and redial up to five different numbers until one of her friends or neighbors responded, at which time it would speak in an intelligible voice, alerting them to come to her house. She could use the same device to summon the police if someone tried to break into the house. A sensor worn on her arm could transmit her vital signs to her doctor's office, alerting someone if her heartbeat became irregular or her breathing labored. The office would be able to dispatch an ambulance within minutes.

Not only are these items all readily available, I tell her, they are within her budget. Electronic pillboxes sell for less than \$20, emergency signaling devices for \$50 to \$200. The most expensive of these products, the home-control system, is about \$500. Yet my mother isn't interested.

It may be partly because she fears the technology and assumes she would not understand how to run "those gadgets." She hasn't heard of all of them. But there seems to be a more important reason she resists the products: to her, they are emblems of age. Because most are not used by the general population, she feels they would call at-





tention to the fact that she needs special help.

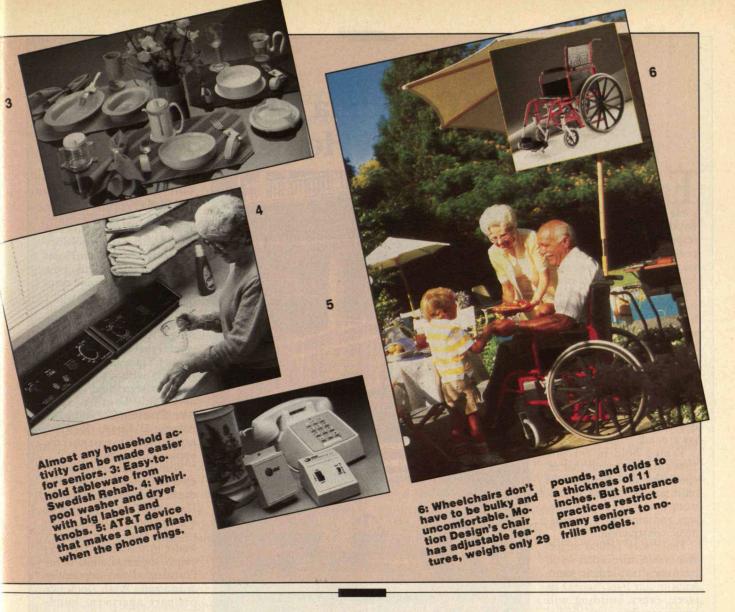
In this regard, my mother is not alone. The aids that 25-year-olds with disabilities accept as a matter of course have yet to find a market among the more than 9 million senior citizens with special needs. "Older Americans tend to avoid stigmatizing devices, products that make them look different," says Kermit Phelps, chairman of the board of the American Association of Retired Persons (AARP). "They would prefer to put up with inconvenience and perhaps even occasional danger rather than use something that marks them as being old."

That should not be too surprising, yet many manufacturers and service providers find it so.

FRANK BOWE, regional commissioner of the federal Rehabilitation Services Administration, recently chaired Congress's Commission on Education of the Deaf. Formerly executive director of the American Coalition of Citizens with Disabilities, his most recent book is Changing the Rules (TJ Publishers, Silver Spring, Md.). Dr. Bowe also wrote "Making Computers Accessible to Disabled People," which appeared in the January 1987 issue of Technology Review. The views he expresses here are his own, and do not necessarily reflect the position of the U.S. Department of Education or the commission.

On the surface, the nation's 28 million senior citizens look like an ideal market for special products. According to the National Center for Health Statistics, 86 percent of people over 65 have at least one chronic health condition. Some 3 million need assistance to perform basic daily activities. About 2 million have mobility problems at home; twice that number have trouble getting around outside. Some 9 million senior citizens have a hearing loss, and about the same number have sharply impaired vision. Moreover, some seniors have money to spare: the over-50 population controls \$160 billion in discretionary income—half the nation's total.

Yet the senior market has proved extremely hard to crack. Thousands of devices designed to make life easier, more convenient, and safer for older people have failed in the marketplace. Viewtron is an example. In the early 1980s, AT&T and Knight-Ridder introduced videotex service in Florida, hoping the home shopping, consumer news, and other features would appeal to the state's many seniors. It didn't, and Viewtron folded. Joining Viewtron in the con-



sumer-product graveyard have been scores of home banking services and robots that dust and vacuum. Venture capitalists that once flocked to start-up firms targeting older consumers now shy away.

Today, companies aiming products and services at the senior market face two major challenges. One is overcoming the "difference factor": companies must devise marketing strategies that convey the benefits of a product without giving seniors the impression that the product will make them look or feel different from others.

The other challenge concerns the health-insurance system, which both puts useful devices beyond the reach of many older people and deters manufacturers from tailoring their products to the needs of the senior market.

Winning Tough Customers

To make products attractive to older consumers, companies need to hide the differences between users and nonusers. Unfortunately, there is no single way of doing this that will work for all types of products. One obvious strategy, as the hearing-aid industry has discovered, is to make the product as inconspicuous as possible. Despite the large number of senior citizens with hearing problems, only 20 percent wear hearing aids. The industry has found that to increase sales to older people, the size of the devices must be greatly reduced; the most popular aids are tiny "allin-the-ear" models that are flesh-colored and almost invisible. In fact, they're so small that many seniors have difficulty handling the tiny volume controls and minuscule batteries.

Of course, that approach doesn't work for household appliances. By accident, Whirlpool Corp. has found a subtle strategy that does work. In 1981, in an effort to draw older customers, the company introduced a washing machine with big dials labeled in large black letters against a white background. The machine, targeted toward elders, was a success—but with younger families, who found it ideal for use in dimly lit basements. It turned out that a product designed for seniors fulfilled a need felt by

Why Grandma Won't Live in a Home

ACH year, the federal government sponsors the construction of some 11,000 units of public housing for elders and handicapped people. Most of this project housing has an institutional atmosphere, with features like sliding doors and added-on wheelchair ramps that set it apart from other living space. Thus, it comes as no surprise that senior citizens do not take any more kindly to "special" housing than they do to "special" technology. They frequently shun the projects, preferring to stay where they are, even if it is increasingly difficult to get around.

Taking hold in the late 1980s are two trends that respond to the demands of older people for less stigmatizing housing: adaptable design and innovative nursinghome construction.

The theory behind adaptable architecture is that we all become disabled at some point in our lives. Sooner or later, every building will house someone with special needs. Although adaptable housing looks virtually the same as regular housing, it incorporates a few subtle differences. The doors are wider and the entrances are flush with the ground to accommodate wheelchairs. The bathrooms have reinforced walls, so grab bars can be installed if wanted (and easily removed if the older person decides to sell the house). Light switches, thermostats, fire alarms, drapery pulls, and bathroom towel racks are all just four feet off the floor. Kitchen sinks, countertops, and cabinets are at usual height, but hidden latches and adjustable plumbing connections allow them to be lowered if desired. According to the National Association of







TOP: A wheelchair ramp can look homey rather than institutional. CENTER AND BOTTOM: "Adaptable" design, which may someday be required in all new homes, serves the needs of elderly and disabled



people without inconveniencing others. The space beneath the stove and the bathroom sink allows a person in a wheelchair to get up close, but it could just as easily accommodate a storage cabinet or a stool.

Home Builders, these features add only about \$2,000 to the cost of constructing a home.

Some states require adaptable design in some buildings but no federal regulations apply. However, the Fair Housing Amendments bill, now before Congress, would mandate that all new multifamily dwellings incorporate "basic universal features of adaptive design." Such a requirement would enable greater numbers of seniors to live comfortably without having to move to segregated, specialneeds-only housing. Sens. Alan Cranston (D-Calif.) and Alfonse D'Amato (R-N.Y.) expect the bill to pass after the presidential election.

With a little imagination, even retirement communities can be made less stigmatizing. David B. Wolfe, a planner of life-care facilities based in Annapolis, Md., is an industry leader in this effort. For example, the rental units in his Providence Point community in Issaguah, Wash., look like ordinary apartment buildings, except that they are adaptable and accessible. They are even rented like ordinary apartments-contrary to many nursing homes, which require deposits in the neighborhood of \$60,000 (and which are not covered by Medicare). The medical facilities, which tend to dominate most nursing homes, are sited well away from the center of the community. Emphasized instead are restaurants, shops, and gathering places that attract younger people from the surrounding area.

At such communities, the antiseptic, hospital-like environment that seniors hate about many nursing homes has given way to the bustling atmosphere of a small town.—Frank Bowe

Many older people can afford only aids covered by Medicare. That rules out most high-tech conveniences, and even eyeglasses and hearing aids.

all. Whirlpool has since put the easy-to-use controls on its entire product line. Now that these features no longer signify a "special" product, the company

is finally attracting older buyers.

In some cases, product design may not be affected at all; clever promotion can do the trick instead. This tactic has been discovered by the producers of a mailorder catalog called "Comfortably Yours: Aids for Easier Living." About half the products in the catalog are "special-needs" devices, yet none is described or illustrated that way. The company goes to great lengths to present its offerings as conveniences that anyone, not just older people, can use and enjoy. For example, it includes slip-on dresses that are ideal for women with arthritic hands, but the description simply stresses ease, convenience, and speed. Arthritis does not appear. Nor does the name of the catalog mention "the elderly," "disabilities," or "medical products."

Despite these successes, many products and services that would benefit elders have yet to be matched with suitable marketing strategies. Closedcaption television, started in the early 1980s as a joint effort of ABC, NBC, PBS, Sears, and the federal government, is a prime example. Given the number of older people who are hard of hearing, and the amount of television seniors watch-often six or more hours a day-captioning ought to be fabulously successful. Moreover, the service is widely publicized, and some 150 hours of captioned programming are broadcast each week. Hundreds of popular movies that have been captioned are available at video stores. And the decoder for captioning, which sells for about \$170, is small enough to sit on top of most television sets.

Nevertheless, the technology has failed to penetrate the senior market. Only 150,000 decoders have sold, mainly to younger people who have been deaf

all or most of their lives.

With more savvy marketing, the ads for closed captioning would play up a crucial feature that so far has not been promoted: the decoder can be turned off, so an older person who would be embarrassed to watch captioned shows in front of company can easily switch back to "normal" viewing. Instead of showing just a TV screen with unfamiliarlooking captions, as the ads do now, they might also depict a second screen with the captions turned off. That way, the promotion would downplay the difference factor instead of highlighting it.

But it is questionable whether this step alone would grab the millions of senior viewers who have resisted closed captioning. It may be necessary both to make the technology even less conspicuous, as with hearing aids, and to incorporate it as standard equipment, as Whirlpool has done with its easy-touse controls. A closed-caption decoder box can now be replaced with a microchip. If, as the congressional Commission on Education of the Deaf recently recommended, these chips are placed inside all new television sets, older people may at last embrace the technology.

The Insurance Factor

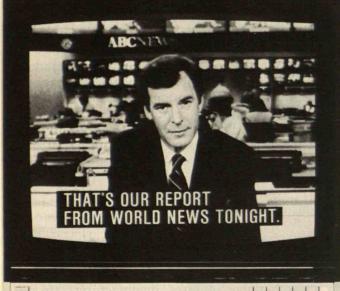
To a great extent, convincing older people to accept technology that will help them is a matter of effective design and marketing. But that's not the whole story. In a vast number of cases, manufacturers are not dealing with older consumers directly but through a large and powerful intermediary: the public and private health-insurance system.

Despite the overall purchasing power of the senior age bracket, many older people can afford only those aids that are covered by Medicare or by private insurance. That rules out most high-tech conveniences. It also rules out mundane items such as safety treads for stairs and bathtubs, handrails or grab bars for bathrooms, jar openers, zipper pulls, Velcro fasteners, and handheld shower sprayers. Medicare even excludes eyeglasses and hearing aids.

In the case of products that are covered, manufacturers have little incentive to make them appealing to consumers. Many older people would rather do without than endure products whose design does not take their needs into account. Wheelchairs are a glaring example. The federal government and private insurance companies buy 90 percent of all the wheelchairs sold in America. Typically, these purchasers look for the cheapest model they can find. They don't much care if it is hard to operate, uncomfortable, or costly to maintain. They don't have to use it.

When the products of an entire industry are bought almost solely by third parties instead of end users, the market forces that normally stimulate quality and innovation at affordable prices are absent. According to a recent report from the congressional Office of Technology Assessment (OTA), this has been the case in the wheelchair industry. Man-





ufacturers have been forced to cater to insurers' demand for lower cost, instead of to consumers' need

for better performance and lower cost.

Where does all this leave people like my mother? She needs a wheelchair that is easy to roll, that resists turnovers, and that works well on unpaved surfaces. Such chairs exist, and they're even covered by Medicare. But they're expensive—nearly \$1,000—and she would have to pay the entire cost herself, then wait months for reimbursement. She does not have the resources to do that, so she has had to settle for the lowest-cost chair on the market, which Medicare pays for up front. OTA has recommended that Congress liberalize these restrictions so that Medicare pays a fixed amount up front for any product, and then reimburses the balance later if the device is found medically desirable.

Another problem with common insurance practices is that they discourage manufacturers from pursuing the marketing strategies most likely to succeed with older consumers. Take "intelligent" home-control devices. Busy working couples find them attractive because they save time and energy; older people need them to prevent over-exertion and accidents. Yet if these products are described as convenience items, insurers will refuse pay. It's a Catch-22: in order to be covered by insurance, products must be presented as fulfilling a medical need, but that turns seniors off.

Clearly, federal rules for medical coverage need to

In closed-caption television, a compact unit attached to the TV set decodes and displays subtitles carried in the signals of many network programs and rental videos. This technology could be a boon for the 9 million elders who are hard of hearing. However, only a few use it.

be revamped; the government should broaden the range of products that are Medicare-reimbursable and pay more attention to product quality. Inevitably, with Medicare costs already high, this raises the question of how to pay for such changes. Fortunately, beginning in 1990, the Medicare system will have a 20-year "opening," perhaps its last opportunity for a generation or more to expand coverage. The generation born from 1925 to 1945—which is 10 percent smaller than its predecessor—will soon reach retirement age. Thus, until the year 2010, Medicare will enjoy a surplus. The surplus period will then end abruptly, as the baby-boom generation enters retirement, boosting the number of senior citizens by as much as 30 percent.

The 1990-2010 period should, of course, be used to accumulate resources for supporting the baby boomers. But some funds could be made available to reimburse health and safety technologies for today's seniors. The government might even find itself saving money in the long run, thanks to fewer in-

juries among elders.

The recent Medicare reforms providing incentives for early discharge from hospitals may have brought this point home to some government planners. One reason Congress enacted the reforms is that law-makers believed home-care technologies were advanced enough to make the change feasible. Portable kidney-dialysis machines and other devices work about as effectively at home as in the hospital. And special telephone-computer linkages permit constant monitoring of outpatients. But when hospitals began discharging Medicare patients earlier after surgery, they started to see high recidivism rates. Many of the patients simply won't use the monitoring and alerting technologies required to make home health care work.

Evidently, technology has progressed faster than psychology. In acquiring and dispensing technical aids for older people, the government needs to learn the same lesson as private companies: seniors won't go along if they're made to feel different.

FOR FURTHER READING

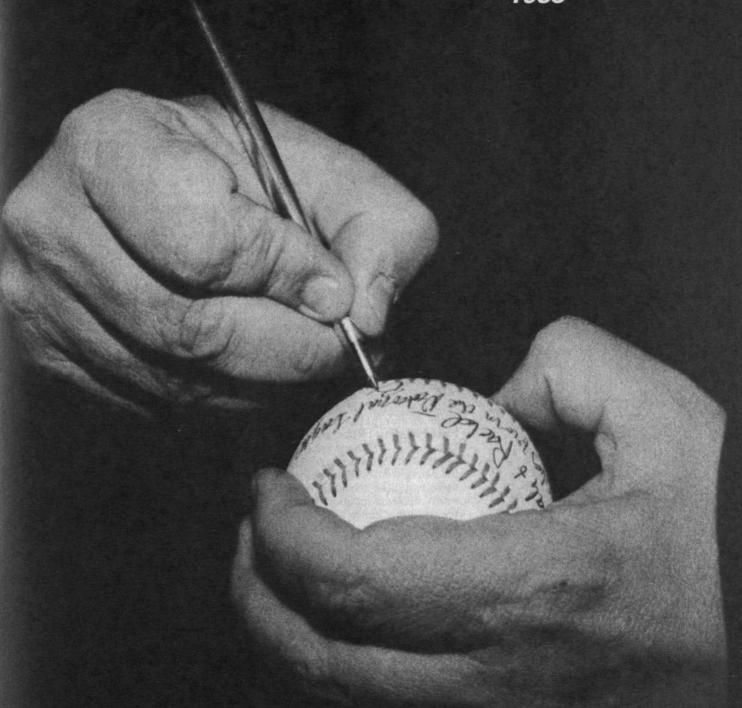
Brown, Pat. "For the Aging and Disabled, Products They Can Use." New York Times, April 21, 1988, C1,12.

Langdon, P. "Housing an Aging Nation." The Atlantic, April 1988.

Office of Technology Assessment. Technology and Aging in America. U.S. Congress, Washington, D.C., 1985.

AUGUST/SEPTEMBER 1988

COMMENCEMENT 1988





UNDER THE DOMES	4
COMMENCEMENT '88: A Perfect Day Giamatti's Address Great Cap & Gown Debate	6 .7 12
A SLICE OF M.I.T. LIFE, À LA TECHNIQUE	13
STEER ROAST XXV	16
DAEDALUS UPDATE	17
L.A. CAMPAIGN LAUNCH	18
ALUMNEWS	20
CLASSES	22
COURSES	44
OBITUARIES	52
PUZZLE	53



COVER

This is surely the first year that the pre-Commencement ceremonies included having the Commencement speaker sign a souvenir baseball for President Gray. But then, this is the first year that we have had as speaker the president of baseball's National League, A. Bartlett Giamatti. Giamatti's address, based on his years as president of Yale, begins on page MIT 7. (Photo by Donna Coveney)

Manufacturing Leadership and Divestment Response



DIVESTMENT STILL DEBATED

In her letter on divestment (January, page MIT 2), Stephanie Pollack, '82, states that she "can no longer justify giving monetary support to an institution that refuses to accede to the wishes of the vast majority of black South Africans . ." How does she know what are "the wishes of the vast majority?" What constitutes the "vast majority?"

Many people believe that they can solve problems by simplistic, painless solutions (divestment in this case). Nobody likes apartheid: not me, and certainly not the South Africans I have talked with. Yet if Ms. Pollack would review her history and analyze the stories that appear in the press, she might see that in some ways things are better; the passbooks that restricted black travel have been rescinded, for example. Change is coming for South Africa, and it is coming in spite of divestment.

Most of the killing and violence that occurs in South Africa and the current state of emergency were caused by blacks battling blacks, not whites battling blacks. Yet the press continues to slant the news towards racial conflict. If the blacks were suddenly enfranchised, there would be wholesale violence, as seven different political groups (from the moderate group led by Archbishop Desmond Tutu to the extreme groups such as the African National Congress) vied for power. Let me remind Ms. Pollack that Nelson Mandela, one of the most well-known black leaders, is a selfavowed and convicted terrorist, one who would be released from prison if he would renounce violence. Yet he re-

I predict only one effect on South Africans from divestment: economic hardship. The South African operations of many American companies are only marginally successful, but they are important for the livelihood of South Africans. Does Ms. Pollack want to assume the responsibility for supporting those South Africans who might otherwise starve as a result of divestment?

South Africa is essentially self-sufficient, but the U.S. depends on South Africa for strategic metals and the land-locked sub-Saharan countries depend on South African ports. What happens if, as a result of divestment and other sanctions, South Africa refuses to sell us the metals we need for our military systems?

I intend to increase my contributions to M.I.T. to offset the loss of [Ms. Pollack's] \$50, and I will continue to invest in the future of South Africa. I hope M.I.T. does the same.

JEFFREY HARRIS, '83 San Bernardino, Calif.

IN PRAISE OF MANUFACTURING

Forty years ago I could have used the new Leaders for Manufacturing program (May/June, page MIT 13, also this issue, page MIT 4). After finishing my degree in electrical engineering I spent eight years in experimental engineering in aeronautics before concluding that research and design were not the best spots for me.

Convinced that manufacturing organizations could benefit from my engineering training, I quit my job, spent the summer back at M.I.T. taking a full load of manufacturing-related courses in the management school, earned a master's degree in industrial engineering at Wright Field, and then found my first job as a production manager. For the remainder of my career I functioned in executive, managerial, and cost-reduction positions in manufacturing operations. It was fun, and I was able to contribute significantly to lower costs and higher profits. Even more today than [when I launched my career], the United States needs engineers in manufacturing to improve American companies' competitive edge. May M.I.T. lead in that direction!

> LAWRENCE W. KELBLEY, '40 Rancho Palos Verdes, Calif.

TECHNOLOGY REVIEW ALUMNI SUBSCRIBER SERVICE

If you've questions or problems about your Technology Review subscription, write us at the address below. Include a copy of your most recent mailing label if available.

For changes of address, please give us 4 weeks notice. Attach your mailing label with your new address and send to the address below.

Alumni Records, Room 12-087, M.I.T., 77 Massachusetts Ave. Cambridge, MA 02139

(617) 253-8270

You Teach Poetry Where?

"What do you do?"

"I teach literature. Poetry, mostly."

"Oh. Where?"

"At M.I.T."

"M.I.T.? That must be . . . interesting."

I've had that conversation probably a hundred or more times, in the nearly Lifive years since I joined the M.I.T. faculty. I've learned to read between the lines-to understand that "interesting" in this case means "bizarre and incomprehensible" and that the tone of voice in which it is said is exactly the tone of puzzled wariness that I'd use if someone told me she milked cobras as a hobby.

But it's the simple truth: I teach poetry to M.I.T. undergraduates. Worse yet, I do it enjoyably, productively, and more or less by choice. The great secret is that M.I.T. is a marvelous place to teach students how to read a poem energetically, imaginatively, pleasurably, analytically. And I think I even know some of the

reasons why.

First of all, M.I.T. undergraduates know a very great deal about a wide variety of things-the life cycle of barnacles, the techniques required to use dynamite to clear the path for a highway, the peculiarities of the ultraviolet spectrum, to name only a few subjects that have come up in my classroom in recent months. And in each case, the subject came up with regard to a poem. Because (as far too few people realize) poems both demand and convey knowledge; they are historically speaking one of the richest repositories of human knowledge, not just about such fundamental "abstractions" as love and grief but about the hard facts of the real world, how things look, sound, interact, change. Poets seek and use knowledge; and good readers of poetry must be willing to follow those poets accurately.

M.I.T. undergraduates generally think they know nothing about poetry (they are in fact wrong; but that's another story). And that in turn means two things. First, those students who take up the study of poetry at M.I.T. do so out of true curiosity, the most vital of intellectual motives. Second, they come to read a poem with few preconceptions

Poetry and the "hardest" sciences meet at the higher, richer end of their respective worlds.

JOHN HILDEBIDLE is associate professor of literature at M.I.T. This essay is reprinted by permission from Technique 1988.

and relatively little arrogance; they expect to have to pay attention, to exert their mind and eye.

And they know how to use both minds and eyes. They are trained and proven observers; they can count, sort, categorize, find pattern and similarity even amid a welter of disparities. They do not, perhaps, often enough get to use these considerable talents on words instead of equations; but the transfer is by no means difficult. Poems invariably demand attention of a precise sort; they

even more often demand that the reader look carefully not just at poems but at the world and human life. Poems are, in short, made to order for someone who knows how to look, what to look for, and what to do with it when they find it.

Knowledge; a certain open-ended curiosity; a capacity to observe carefullyadd to these qualities an interest in stating things precisely (even algorithmically) and an extra-large (by the world's standards) dollop of sheer intelligence and imagination: what more could one want, in a student of poetry? The teacher (or rather, the poem, which does the teaching) must sometimes work against these traits—especially against the vain hope that a word can be taken to mean only one thing; but at least the trait is there, to be used against itself.

And one can, as a teacher of poetry, always feel like something of a missionary. The American poet William Carlos Williams insists that "It is difficult to get the news from poems, yet men die miserably every day for lack of what is found there." I believe that (and not just for "men") not to know poetry is not to know life. So here I stand, bringing the vital news, especially vital to those who are by any reasonable measure the brightest and most promising of young people: if they miss the news, we're all in trouble!

How nice, too, to be able to set the record straight-to scribble, on a blackboard (or for that matter, on a mind) full of numerical data and complex equations, the greater wisdom: "Imagination is more important than knowledge." Where else to look for such imagination but in poems, which have always held within them the truth that imagination is the inescapable pre-requisite?

That the particular wisdom in this case came not from Wordsworth (who would absolutely have agreed) or Shakespeare (who had both imagination and knowledge and could weigh the two) or Marianne Moore or Villon or Sappho but from Albert Einstein simply proves my case: poetry and even the "hardest" of sciences meet at the higher, richer end of their respective worlds. At M.I.T., for instance. In classrooms full of prospective chemical engineers or particle physicists or economists, all of whom are or can readily be made to be expert and passionate readers of poems.



Killian Award to Waugh

The highest tribute the M.I.T. faculty can pay to one of its own is the \$5,000 Killian Faculty Achievement Award. For 1988-89 it belongs to Professor John S. Waugh, whose "infectious enthusiasm for quality science has spawned one of the finest physical chemistry programs in the world," in the words of the selection committee's citation.

Waugh has been at M.I.T. since 1953, when he finished the doctorate at Caltech. He became a full professor in 1962 and in 1973 was named the first Arthur Amos Noyes Professor.

As a chemist, Waugh is identified especially with the analytical tool known as nuclear magnetic resonance-a system that stimulates and then analyzes the magnetic moments of atomic nuclei. The selection committee describes it as "a versatile and powerful tool with an enormous impact on chemistry, biology, biochemistry, condensed-matter physics, materials science, and medicine." From Waugh's laboratory have come new understanding of the phenomena and new techniques that are now in widespread use.

As a teacher, says the committee, Waugh's "fine mentorship qualities have enriched many students," and he has been a role model for many colleagues at M.I.T. and elsewhere.

Waugh studied at Dartmouth before going to Caltech, and he has taught as a visiting professor at many universities in the United States and overseas. He holds four major prizes in chemistry as well as Caltech's Distinguished Alumnus Award.



J.S. Waugh

Anniversaries

Two academic anniversaries will be marked by special events at M.I.T. next fall:

☐ Twenty-five years after the founding of Project MAC, its successor, the Laboratory for Computer Science, will stage a birthday reunion. The two-day celebration is being planned by Professor Albert R. Meyer for October 26 and 27 with appropriate social events and a symposium on current computer science re-For further search. information: Paula A. Vancinni, M.I.T. NE43-109.

☐ The Chemical Engineering Department will mark the 100th anniversary of chemical engineering education in the U.S., which began at M.I.T. There will be social events on October 7 and 8 and two professional symposia on October 8. For further information: Professor James Wei Sc.D.'55, M.I.T. 66-342. ☐

High-Pressure Manufacturing?

righ expectations accompanied the enrollment of the first 20 students in the new interdisciplinary graduate program, Leaders for Manufacturing, during June. By June 1990 they will have earned two degrees, one from the M.I.T. School of Management and one in a field of engineering in a program jointly directed by Professors H. Kent Bowen, Ph.D.'71, for the School of Engineering and Thomas L. Magnanti for the School of Management.

President Paul E. Gray, '54, called it "a major commitment to manufacturing in America"-an effort to "revitalize intellectual interest in manufacturing and to focus the energies of some of the nation's most talented young minds on the problems of this critical economic sector." Dean Gerald L. Wilson, '61, of the School of Engineering said the new program gives M.I.T. a long-needed opportunity to "integrate the various components of complex manufacturing operations . . . in order to investigate the process as a whole." And Lester C. Thurow, dean of management, added his hope that the new program might eventually yield a generation of managers more qualified and willing "to take risks on new technologies."

Though it found no argument with the program's goals, some of this enthusiasm was lost on the Graduate Student Council (GSC),

which objected to the fact that the program's enrollees would earn two master's degrees in two years while writing only one thesis. Since most students require two years for a single master's degree, the idea of two in two years was "unrealistic," said GSC. "We are fundamentally concerned about the increase in pace and pressure this program will entail."

Dean Frank E. Perkins, '55, of the Graduate School found GSC's reaction a bit extreme. Two master's degrees in two years are not unusual now, he said; many students petition the Committee on Graduate School Policy (CGSP) for such programs. And perhaps it now typically takes longer "than may be in everybody's best interest to get one master's degree," said Perkins. A larger concern for him is the issue of pace and pressure and the fact that CGSP had less time than usual to weigh the proposed new curriculum. His guess, says Perkins, is that the program will have "a fair amount of evolution" before the first degrees are granted.

Leaders for Manufacturing has nine leading U.S. companies as sponsors-Alcoa, Boeing, Digital Equipment, Hewlett-Packard, Johnson & Johnson, Kodak, Motorola, Polaroid, and United Technologies. They will support both the graduate program and cooperative research to identify and study critical problems in manufacturing. Eventually, say the directors, perhaps 10 to 15 percent of the faculty in engineering and management will be involved.

SPORTS ROUNDUP

1987-88 M.I.T. ATHLETIC HIGHLIGHTS

COMPILED BY THE M.I.T. SPORTS INFORMATION OFFICE



MEN'S SOCCER

Lost to Harvard 1-0. Harvard later finished second in the nation in Division I.

WOMEN'S TENNIS

Dheera Ananthakrishnan '90 was named a New England Women's Eight All-Star. Team was 11-7 overall.

MEN'S TENNIS

Ben Spehlman '88, qualified for NCAA Division III Championships...

MEN'S CROSS COUNTRY

Ranked 14th nationally, Rod Hinman '88 placed 34th in the national Division III championship.

WOMEN'S CROSS COUNTRY

Won the MAIAW Class B-C State Title.

BASEBALL

Mike Griffin '89 made Greater Boston League All-Star Team.



FOOTBALL

Two football players took M.I.T. laurels. Hugh Ekberg '88 became the leading ground-gainer (2078 yards) and point-scorer (126). Peter Gasparini '88 became recordholder for total yards passing (1398) and touchdown passes (11) in a career.

MEN'S FENCING

Second in New England Championships.

WOMEN'S **FENCING**

Linda Ystueta '88 named New England Women's Fencer of the year for fourth consecutive time. Ystueta also finished 17th at NCAA Championships.



INDOOR TRACK

Undefeated (9-0). New England Champions for fourth consecutive year. Bill Singhose '90 set school records for points in a season (112 1/2), points in a meet (21), and pole vault (15' 5 3/4"). Singhose placed third in Division III National Championship in pole vault.

MEN'S ICE HOCKEY

Destroyed Caltech in the second Beaver Cup, 13-0.

MEN'S BASKETBALL

Had 11 wins for most since

WOMEN'S SWIMMING

Yvonne Grierson '90 won NCAA Divison III Championship and set national record in 100 yard butterfly (56.18).

MEN'S GYM-**NASTICS**

Qualified for United States Gymnastic Federation Division II-III National Championships for first time.

WOMEN'S GYM-**NASTICS**

Allison Arnold '90 won ECAC Championship on uneven bars with a score of 8.8 of a possible 10.

LACROSSE

Won initial Pilgrim League Championship. Had most wins since 1969 (9). Had five Pilgrim League All-Stars (Tom Dorf '88, Tim Mattox '88, Pat Nee '89. Rich Rice '88, Mike Gaidis (88).

HEAVYWEIGHT CREW

Swept races with Dartmouth and Coast Guard for the first time ever.

WOMEN'S SOFTBALL

Julie Brown '88 made NEW 8 All-Star team.

WOMEN'S BASKETBALL

Darlene Dewilde '88 was in top ten in three different categories in NEW 8 (scoring-second, rebounding-seventh, blocked shots-first).

PISTOL

Free pistol team won NRA National Championship. Vicki Rowley G placed fourth in standard pistol at nationals.

WOMEN'S VOLLEYBALL

Won New England Women's Eight Tournament. Julie Brown '88 named to the NEW 8 All-Star team. Athena Cozakos '89 named NEW 8 Tournament MVP.

SOUASH

Had second winning season in history of the sport. More wins (12) than ever before.

RIFLE

Eugene Opsasnick '88 qualified for NCAA Championships.



OUTDOOR TRACK

Undefeated (5-0). Won New England Division III Outdoor Championship for first time since 1983. Scored most points in history of the championship (123 1/2), won by greatest margin in history of the championship (611/2 points). The combined indoor and outdoor track records over the last 50 opponents in dual or triangular meets is 50-0. M.I.T. has not lost a track meet to a Division III team in over eight years.

GOLF

15th consecutive over .500 season



Commencement 1988: No Surprises

've waited 10 years for a Commencement Day like this," President Paul E. Gray, '54, was quoted as saying on the morning of May 27. Sunny but not unbearably hot—no small matter for those who remember sweltering through the ceremony in 1984. Not a cloud in the sky—no small matter for those who spent Commencement '86 wondering if God had gone back on His promise to Noah never again to destroy the world by water. Absolutely perfect.

Close to 2,000 degrees were dispensed to some 1,850 new alumni with impressive efficiency: undergraduate degrees were handed out by President Gray, and advanced degrees by Provost John M.

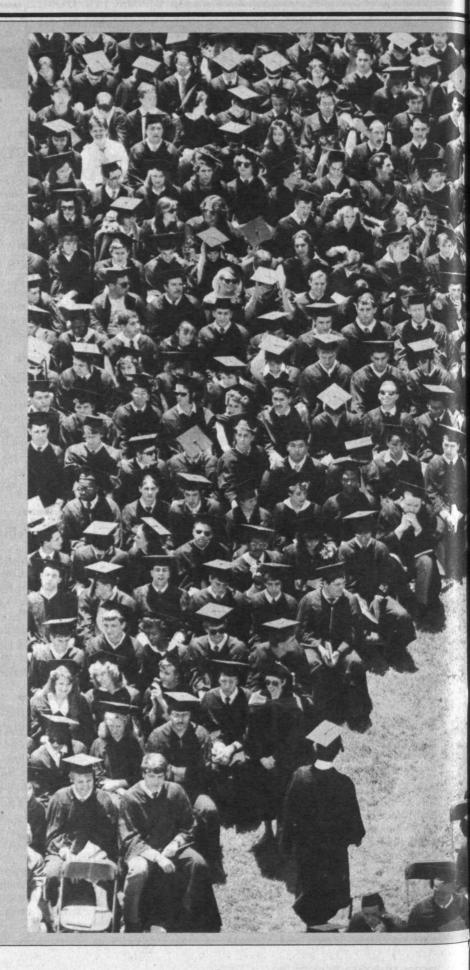
Deutch, '61.

The Commencement Address delivered by baseball's National League President and former President of Yale A. Bartlett Giamatti was not only inspirational, as demanded by the occasion, it was—wonder of wonders—vastly entertaining. There are probably a few thousand people waiting for Giamatti's book as a result of that morning's insightful and hilarious sampler of the perils of a college presidency.

Seniors were asked by a group calling itself the Coalition to Humanize M.I.T. to sign a pledge of social and environmental responsibility. The concept was lauded by a number of faculty and administrators, including Associate Provost Samuel J. Keyser. Significantly, signing the pledge was a form of political action that did not interfere with anyone else's opportunity to listen to

and observe the ceremony.

President Gray, in his charge to the graduates, focused on the "obligation of public service." At once unusually able and unusually well educated, M.I.T. graduates have an out-of-the-ordinary responsibility to be "servants of the public interest and the common good," at a time when this democracy is threatened by widespread scientific illiteracy, Gray said.







The Abolition of Evil and the Restoration of Paradise

By A. Bartlett Giamatti

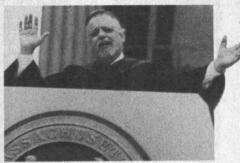
his occasion is, I know, a solemn one, meant to celebrate the graduates, to affirm us in our commitment to seeking the truth, and to figure forth the institution's role as conveyor of that common life we call civilization.

I have thought much on our universities in the last two years, and today I want to share some of those ruminations with you. Specifically, I wish to ruminate on being a university president, which I was once. What does this have to do with you, the graduates? Aside from enriching this moment and your lives in general, my ruminations will eventually prove splendidly relevant.

Being president of a university is no way for an adult to make a living. Which is why so few adults actually attempt to do it. It is to hold a midnineteenth-century ecclesiastical position on top of a late twentieth-century corporation. But there are those lucid moments that reveal the numinous beyond and lay bare the essence of it all. I have had those moments. They were all moments of brilliant failure. But string those glistening moments of defeat into a strand and you have the pearls of an administrative career.

In the six months between being named president of Yale University in December 1977 and taking office in July 1978, I had ample opportunity to receive advice. I listened to many people. I learned, for instance, that because the corporate world is only interested in quarterly results, it talks a great deal about long-range planning.

It was clear to me that Yale needed



A. BARTLETT GIAMATTI is the president of The National League of Professional Baseball Clubs and was president of Yale University from 1978 to 1986.

some of that, too. We needed a policy. I, of course, had no policies. I had a mortgage and one suit, but no policies. I cast about. I solicited data and forecasts and projections and models. I did comparative studies, longitudinal studies; I made a flow-chart; I fired management consultants. I went in search of a policy. What was it that Yale needed most, wanted most and would most contribute to solving our deficit, enhancing our quality, and making me a manager?

One night in early April, 1978, crouched in my garage—as I was trying to memorize the trustees' names, particularly the ones I had met—it came to me, and I wrote, right there, between the lawnmower and the snow tires, a memo. On July 1, 1978, my first day in office, I issued this memo to an absent and indifferent university. It read: To the Members of the University Community: In order to repair what Milton called the ruin of our grandparents, I wish to announce that henceforth, as a

This address was adapted from A Free and Ordered Space, to be published in November 1988 by W. W. Norton & Co. Inc. © 1988 A. Bartlett Giamatti.



Eighteen hundred people, similarly garbed and seated in rows (and imaginatively photographed, we might add), form wonderful patterns (overleaf and facing page). But it is their individual faces and those of their families that tell a story of Commencement that is unique every year.







matter of University policy, evil is abolished and paradise is restored.

I trust all of us will do whatever possible to achieve this policy objective.

The reaction was quite something.

our young members of the faculty in comparative literature wrote an open letter to the New York Review of Books proving that Milton was not talking about evil in Paradise Lost, but about irony and the patriarchal abuse of power. A junior in Yale College, spending the summer doing a leveraged buyout of a Tastee-Freeze in Easthampton, wrote me a gracious letter. She recognized the pressure one was under to have a business plan, but she hoped I would wait until she had graduated before changing things very much. An alumnus in New York, on Yale Club stationery, wondered why the hell we always had to get so far out in front.

In September, the Yale Daily News wrote the first editorial about my memo. Its opening sentences were: "Giamatti's administration is off to a miserable start. Rather than giving us control over our lives, or at least

addressing concerns of students—such as the crying need for a student center so we can make friends or any of the myriad of other injustices that riddle the fabric of the quality of life here, the new administration is insensitive and repressive and the future bodes awful." Though one of the best written of the *News* editorials, it was, to be fair, also the first.

Since the students were back and the *Daily News* was publishing, the major media outlets now had a source for news. Student stringers went to work. In a small article bylined "Special to The New York Times," the country's newspaper of record misspelled my name and said a Harvard professor had found a letter from Milton to his parents in the Yale Library.

The Washington Post ran a picture of the memo in the Style Section and wrote a side-bar in a box quoting an FDA lawyer as asserting that evil had been abolished three years earlier, that the regulations had been printed in the Federal Register, and that nobody he knew-believed evil was bad for you in any case.

The Wall Street Journal wrote a pithy editorial, pointing out that fat, liberal, effete, Marxist-oriented

Eastern universities, and Stanford, too, were all in a plot to undermine the Republic, free enterprise, and greenmail as we know it today. "What we need," said the *Journal*, "is not more talk about evil but some decent courses in risk arbitrage."

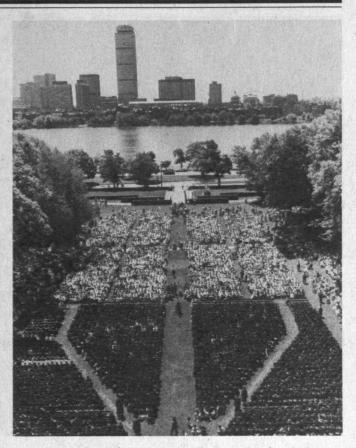
George Will wrote a column citing Montesquieu, Thomas Aquinas, Locke, and Ernie Banks; William Buckley said Milton was "all very well, but it is typical of President Giamatti and his ilk to cite a secular authority on evil as if, of course, those who have passed any time down in the agora or out on the Rialto needed an authority to know the palpability of evil in all its camaraderie and liberal camouflages."

s you know, a university president has responsibility not only for the internal workings of the institution but also for external representation and relations as well. Of all the moments I remember—speaking to alumni, visiting foundations and corporations, mayors and governors and private individuals; going to high schools and board rooms and newspapers and dinners and recep-









tions—the moment I remember best is the morning I saw Congressman Phlange from the third district of a

state we will call Grace.

The Congressman's office is a series of dark paneled warrens, each leading to the other. As I enter, I see on the wall a framed poster of the last major arts festival held in the district-on August 17, 1937. There are two chairs, a table with copies of Colliers, and a telephone that cannot call anything.

The first receptionist is reading her high school yearbook and drinking Diet Sprite, so I approach the other receptionist, who is less busy.

"Mr. Giamatti to see the Congressman, please," I say. She is wearing a button that says, "I am a Phlangist." She looks up and says, "He's either in the district or on the floor. They're not sure."

I sit in the corner by the phone. Suddenly the inner door opens and a middle-aged person with eyeglasses hung on a green cord around her neck and carrying an appointment book, a clipboard, a stack of letters, a cup of coffee, and a Snoopy lunch box comes up to me and says, "He'll see you now; please follow me." She takes me out the door, down the hall to the right, and through the first door we come to.

We go past a word processor on an empty desk, down a short corridor filled with overflowing wastebaskets, then a sharp right, past a young man methodically shredding what looks like mail, and into the Congressman's office.

The Congressman is reading behind a huge desk, surrounded by plaques, awards, trophies, pictures, laminated scrolls and six autographed footballs. There are four easy chairs, a chocolate-colored wastebasket, an American flag, and a mother-of-pearl paperweight the size of a basketball with "Republic of China" in blue letters across the

"Doctor, how are you. It's a pleasure. Please sit down. Can we get you some coffee. What brings you to Washington." He has not yet looked up. "I'd like to get a picture of us together. I'll find the photographer." And suddenly he is gone, vanished out the door.

Then he is back, with a photographer and a tall, slim woman, about 30, in slacks, a blue work shirt, a denim vest, boots, her dark hair pulled back in a bun. "Doctor,

this is Ms. Incomparable Worth, my legislative assistant for education. She'll sit in. There." A flash has gone off. The photographer leaves.

Ms. Worth speaks: "We think the NIH cuts should go through. We're not impressed with your fatuous argument that we can't change the rules halfway through the game. We believe student aid only benefits the rich and poor; rather than stopping abuse, we'd rather do away with everything. We do not believe in a federal science facilities fund nor in the nonprofit postal subsidy; we think it would be the height of fraud and abuse to fund the humanities. We intend to uncap retirement, cap technology transfer, cut the NEA and NSF, get rid of the Library of Congress, and slash the Health Manpower Act. We want to get this country moving again."

The Congressman beams. "Doctor, let me tell you it is an honor having you here. We have a college in the district; they do a wonderful job. Education is a wonderful thing. Made the country what it is today. Look what we've got-a huge deficit, unbalanced trade, weak dollar, corruption in church and state separated, of course. Anything I can









do, tell me. Great to see you."

I went back, past the young man, shredding, past the wastebaskets, past the silent word processor, into the hall. Though I had not said a word, I had done what I came to do. I had had my picture taken, seen a staffer, met a congressman, heard all the issues touched definitively. Our system is working. The visit remains in the mind as a pearl.

here is only one other moment that stands out: a brief but glistening session, not long before I left, with a university-wide, community-based, self-selected group called the Standing Committee on Special Interests. This committee is the special-interest group that convenes to pursue a special interest if there is no pre-existent special interest group empowered to pursue that special interest.

The committee monitors public utterances to see who might be offended and then it takes offense if no one has the time or inclination. It watches power structures; it petitions for redress; it rallies, gathers, assembles, queries, blockades, even occasionally assaults sincerely in

good causes. It is an extraordinarily hard-working group, never at rest, always vigilant. Recently, the Standing Committee had taken up the cause of the inequality of income distribution in North America, the preservation of all stained-glass windows at Yale, structural unemployment in the Northeast, and women's volleyball.

I was summoned to meet the Standing Committee. I said I would meet them in the Trustee Room near my office. They said they were not sure they could all fit in the room. I said they could send delegates; they said they did not trust each other enough to delegate any of their number. I said, it is up to you. They cancelled. Some clergy in town immediately petitioned on their behalf. I caved in.

When they finally arrived, there were only seven of them. I asked what I could do. A long silence. "What is the issue?" I was baffled. Finally, the spokesperson said, "We are sorry to come to you like this, but we are very deeply concerned that no one in the administration is paying any attention to the most pressing problem of our time, the problem of evil and the restoration

of paradise."

"But," I said, "we tried to solve that. I sent a memo on that years ago." "We weren't here years ago," said the spokesperson. "We are here now. What can we do to make it better?" We talked long into the night.

n some ways, that conversation and my versions of all the other conversations are variations upon that serious and splendid conversation that is any great university, anywhere in the country. The university today is very different from the one 25 years ago, or 50 or 100 or 250 years ago, and yet it is not different; tough as they are, they are still fragile institutions. They are still a constant conversation between young and old, among students, among faculty; between faculty and students; a conversation between past and present, a conversation the culture has with itself on behalf of the country. The university lives through all its voices-and the conversation does not stop there.

Perhaps it is the sound of all those voices, over centuries, overlapping, giving and taking, that is finally the









Chairman of the Faculty Bernard J. Frieden (facing page with the symbol of his office) and 1987-88 President of the Alumni Association Raymond S. Stata, '57 (immediate left, with the symbol of his office) were among the leaders of the Institute community who participated in paying tribute to the Class of '88.

music of civilization—the sound of human beings shaping and sharing, mooring ideals to reality, making the world, for all its pain, work. The university is a place where the mind learns how to make ideas, which is the mind's most durable product. It is neither a paradise nor the worst spot we have ever been in; it is a good place which continues to want to make her children better.

Its essence is that give and take, that civil conversation in its innumerable forms. When that conversation, the to-and-fro of ideas, is stymied or foreclosed or frozen, when the questing for truth is told it must cease because there is only one Truth and it is Complete, then the institution in its essence is chilled and its life threatened.

The enemy of the university is finally not dissent, not disagreement, not disagreeableness. Gentility is the mark of a great finishing school, not a university; a great university cares not for the genteel. It cares for the blood and sinews of ideas, in noncoercive combat with other ideas. The "noncoercive" quality is fundamentally the key—a combat that does not seek to take a life but to add energy, add passion,

add logic, add commitment to the open life of the mind in the service of a more just society.

The denyers of left or right, diagnosticians for whom all illnesses are similar because all cures are identical; the purveyors of an ism, the dealers in system, the myopic for whom all the world's pain is simply reduced to their cause; the simplifiers who tell you that they are idealistic because they have boiled life down to a bumper sticker, a t-shirt maxim; the reductionists who pretend to promote global concern so as to promote a personal preoccupation—these are the enemies of give and take, of debate.

The shouters who want it now care nothing for exchange, for connection each to each, for working it out. What must be fluid, so each of us has the freedom to promote another's freedom of mind and spirit and belief, they would freeze, catching us all in the amber of their dogma. In some ways they are the subtlest enemy of the university, of the life of the mind—not because they win the day—but because they force us into us and them, fragmenting precisely when they most hunger for solidarity, splintering the

very sense of community they ache to form. You have encountered this impulse here, you would have in any college or university and you will in the wider world.

ll I learned in the university that is worth passing on to you is this: Do not write off the dogmatist, do not acquiesce in the Apocalyptic style. Insist on conversation even where it is not proffered. Have the courage to connect, the courage to strive to keep the shouting down and the conversation open. Because I think only in that way eventually will equality-of sexes and races and opportunity—finally come; only in that way will the homeless get housed and the hungry fed and the poor find work and the city be rebuilt.

To have the moral courage to avoid the selfishness of self-righteousness and to assert positively the need we each of us has for the other—that is the real work of humankind. It has begun here, and it will, I know, be carried out into a life that will remember how inhumane it is to leave another alone.



Battle Lines Drawn Over Caps And Gowns?

Pomp and circumstance. Caps and gowns. Universal commencement traditions as old as the idea of the university—right?

Wrong. Oxford and Cambridge may never have given up the forms of medieval dress that marked their scholars, but a progressive institution in the New World did not go lightly into that ancient mode.

And so, at the turn of the century and into the advent of the Roaring Twenties, the Letters columns of *The Tech* chronicled the burning controversy at M.I.T.: Should students adopt the wearing of caps and gowns at their commencement exercises?

It was a battle that pitted students against one another and against the M.I.T. admin-

istration. And perhaps because it juxtaposed issues of social class and the self-image of the institution, it was a controversy that took more than a quarter of a century to resolve.

The "cap and gown question" was already much debated when The Tech printed an editorial arguing that "Yale, Harvard, Brown, and several other colleges have adopted [the wearing of caps and gowns] with satisfaction to all."

The editorial was quickly challenged in a letter from a man who identified himself only as a member of the Class of 1893. "It is perfectly proper that Yale, Harvard, Brown, and the several other colleges adopt it," he wrote, "but it would be entirely out of place for the Institute of Technology to do so. The gown has always been identified with universities where theology, law, and the languages are studied. It is a garment adopted from the universities of England, where it is not only worn on Class Day but also at all times by the students. It is the insignia of the professions studied at these institutions. The divinity student continues to wear the gown in practicing his profession; the law student, in England at any rate, does likewise; while the literary man wears it in his study.

"Is the gown the insignia of the professions taught at the Tech? Would



The Class of '23, the first to graduate in caps and gowns, walked to Symphony Hall for a ceremony that included the inauguration of President Samuel Stratton.

we after graduation take it with us into the factories, the mills, mines, foundries, railroads, chemical works, and the many other industrial establishments where Tech men are to be found? No. It would be better to take a pair of overalls, a jumper, and an old slouch hat, the emblems of our professions . . ."

(It is interesting to speculate that if Mr. 1893's argument had won the day, a large number of M.I.T. students might today be graduating in hard hats.)

This counterargument drew its own rejoinder two months later, when another senior used the columns of *The Tech* to ask, "How can we find anything that would lend more to the dignity of the occasion?" But his class, like its predecessors, graduated in the *de rigeur* frock coats and top hats.

In 1899 the Harvard students, who had been wearing gowns for all academic activities including classes de-

demic activities including classes, decided that the last two months of the academic year were simply too hot in Cambridge, Massachusetts, for attire first adopted in Cambridge, England. They voted to restrict this "impractical" garb for Class Day and commencement. The Harvard Crimson protested this flaunting of tradition, but The Tech's editors heralded a new day coming, when the cap and gown would disappear from American academic settings altogether.

That new day never dawned. The Class of 1907 ran a referendum, with caps and gowns winning by an impressive 2 to 1 margin. That vote at M.I.T. caught the imagination of an editorial writer at the *Boston Herald* who opined: "Let the world know that it is as dignified to build a bridge as to dig up a Greek city." (The latter activity, presumably, occupied grads of other colleges.)

Following their ballot, the seniors circulated a manifesto declaring that the adoption of cap and gown would mark M.I.T. as a college, not merely a trade school. The manifesto and a class letter to the faculty made clear that the cap and gown issue had acquired a new ideological thrust. The students spoke stirringly of

equality and democracy.

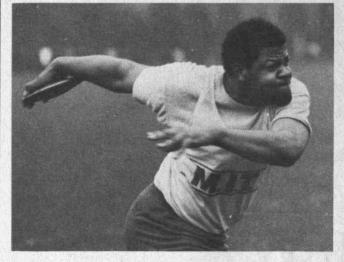
'The question of uniformity of appearance will be settled by the Cap and Gown," class secretary Alexander Macomber wrote. "In past years, the fact that some men appear in the regulation frock coat and tall hat while a large number are not able to afford this has occasioned feelings of embarrassment to many. Also men who actually could not afford it have strained their resources to appear in this way while others are obliged to cover their feelings and appear in ordinary attire . . . "Fairness, the proponents of caps and gowns noted, could be bought for less than \$10 per student, and rented for \$2.

Citing a lack of unanimity in favor of the change, however, and ignoring the simple majority, the administration under President Henry S. Pritchett voted down the proposal. But it proved to be only a temporary setback. The M.I.T. Archives reveal almost nothing about the last gasp of the frock coat, but on March 28, 1923, the faculty voted to endorse the wearing of caps and gowns by "a considerable majority."

So the Class of 1923 marched in caps and gowns all the way from Cambridge to Symphony Hall to celebrate their graduation, the inauguration of President Samuel Stratton, and the launch of a new tradition.—Debra Cash



REVIEW REVIEW







PHOTOGRAPHS BY:

Peter Mui,'83,
Robert D. Newman,'89
C. Hunter Baker,'90
Haran Subramaniasivam,'89
Benjamin Teitelbaum,'89
Tom R. Junk,'88
Ariel P. Poler,'88
Bill Coderre,'86
Alan D. Devoe,'88
Kim A. Kellogg,'88



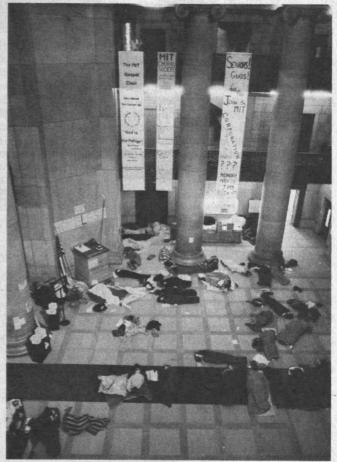


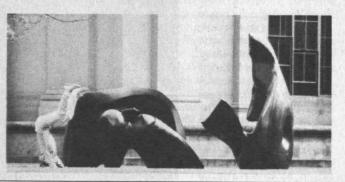












Steer Roast: The Ultimate Barbecue

By Diana ben-Aaron,'85

There could you find 700 pounds of beef, 26 bags of charcoal, bluegrass music, and an update on Tech grads to rival the *Alumni Register*? At Steer Roast XXV, of course—the 25th annual spring barbecue in the Senior House courtyard.

Though the event has grown over the last quarter century to cover three days of festivities, the heart of Steer Roast is the Saturday meal, which this year resembled a cross between Woodstock and an employees' picnic at Digital Equipment Corp.

The 180-odd residents of Senior House were joined by more than 300 guests that included alumni, alumnae, faculty, and students from other houses who all paid \$7 a head (to stay with the cattle theme) to eat potato salad, lasagna, cornbread, ice cream, and of course, roast beef.

They dined under threatening skies to the music of Southern Rail, the bluegrass band led by former Senior House tutors Jim Muller, Ph.D.'83, and Sharon

Horovitch, Ph.D.'80, that has performed at every Steer Roast since 1979. (Last year Southern Rail cut its first record, Looking For the Lighthouse, on Track Records.)

Steer Roast has a manic intensity that comes partly from its timing: usually the first weekend in May, this year it fell on April 30. That's the last weekend students with papers and finals can even think of going to parties. They're about to do 80 percent of their work in 20 percent of the term, but first—Steer Roast!

Culinary History

Steer Roast actually began as a humble chicken roast, remembers Pat Eden, who with her husband, then-faculty member Murray Eden, served as house-master of Senior House from 1962 to 1976. (The Edens now live in Maryland, where Murray is chief of Biomedical Engineering and Instrumentation at the National



Institutes of Health.) It soon grew to a lamb roast, and finally to a quarter or a half of a steer. *Technique 1964* noted that "[Senior House] Social Committee helped satisfy the appetites of House members with a lamb roast followed by a two hundred fifty-pound steer roast in Bosworth Court. Anyone for Elephant Shrewsbury next year?"

In 1968, the steer weighed in at 500 pounds. That was not exactly an elephant, but by 1970 the main course was heavy enough to break the spit. Thanks to "on the spot, off the cuff welding" by the chefs (this is M.I.T., after all) that show went on. In 1969, according to Technique, "the Steer Roast fed bull to house residents and their faculty guests, like Prof. [Jerome] Lettvin, 47, and 'Doc' [Harold] Edgerton, '27, who are now honorary house residents." Incidentally, the 68-year-old Lettvin, who was present at this year's roast, will be moving to Rutgers in two years thanks to M.I.T.'s policy of mandatory retirement at age 70.

Steer Roasts since 1979 have grown increasingly elaborate, running to live band parties after the barbecue, and casinos, open bars, and movie showings the night before. Though some of the movies shown have been noncontroversial (Woodstock, Monterey Pop, cartoons), there is an 11-year-old practice of showing films

usually labeled pornographic at Steer Roast. This year, 32 Senior House residents signed a petition asking that pornographic films not be shown as part of the occasion, and Caroline Whitbeck, lecturer in mechanical engineering, wrote an open letter to her faculty colleagues urging them to boycott Steer Roast if the films were shown.

The films went ahead on schedule, however, and though the faculty boycott was not 100 percent effective, departing housemasters lay and Margaret Keyser, who had supported the student petition, did not attend. Says Pat Eden, "I regret the pornographic films, but it offends me that people were trying to use a social occasion to punish students." Philip Sanborn, 89, organizer of this year's films, noted in The Tech that no sadomasochistic, bondage, or violent films were presented.

Continued on page MIT19



A Captivating Flight of Fancy



The world paid glowing tribute last April to a high-tech recreation of a prison escape, but modern-day wardens needn't fear a rash of "copycat" flights to freedom. The event that captured the global imagination was, of course, the flight of Daedalus 88. The human-powered aircraft designed and built at M.I.T. crossed the 72.4 miles of the Aegean between Crete to Santorini in record time, recreating the mythical escape of its namesake 3500 years ago on wings of wax and feathers.

It was a media event without parallel in recent M.I.T. history. "It is very rare for an event that is clearly non-political to capture so much and indeed global attention, as did the flight of the modern *Daedalus*. And rightly so, for it is rare for an achievement like this to be so multifaceted and so meaningful." Thus spoke the Greek Minister of Education Apostolos Kaklamanis at a post-flight celebration.

Daedalus was not designed for journalists' convenience. The weather window was very narrow, raising for those covering the flight the possibility of a good long wait (and on an island, no less). The fact that it was a Greek island in the wine dark sea undoubtedly eased the tedium.

The weather on March 31, the day after the *Daedalus* team arrived in Crete, filled all their requirements: winds of three knots or less, temperature below 70 degrees Fahrenheit, visibility to the horizon, and wave swells in the Aegean of less than three feet. From the inception of the project it was known that a simultaneous occurrence of these specific meteorological conditions was a

long shot, and this happy confluence seemed too good to be true to the 60-odd journalists gathered in Iraklion on the island of Crete. And indeed it was—the crew had been unable to complete the necessary logistical preparations in less than 24 hours, so it was impossible to attempt the flight that day.

Thus the long wait began. The first week alone there were four alerts, which involved the team arising at 3:30 A.M. and the press an hour or so later. Twice the pilot was actually in the cockpit of the plane when the flight was scrubbed owing to a change in the weather outlook. Other mornings the alert was cancelled in the wee hours before all systems were go.

The alert process began each evening when Director of Flight Operations Steve Bussolari, Ph.D.'83, analyzed the 5 p.m. weather data and delivered the results at the nightly press briefing in the Hotel Xenia playroom, now converted to a newsroom. There were 11 days on alert, 13 days with no alert (less than optimum weather could often be predicted for several days ahead) and six test flights.

The press, by necessity, began to trickle away at the end of the first week. A small corps of about eight reporters and photographers remained on the island for the duration, fending off bouts of cabin fever with the periodic predawn awakenings. For those unable to afford the luxury of an indefinite wait, there was a conveniently scheduled 5 A.M. commercial flight from Athens to Crete that would get reporters to the island in time to witness an actual flight attempt.

The Greek government played a sub-

stantial role in the success of the *Daedalus* operation. Navy and Coast Guard boats were on call the entire time and the team had access to a Coast Guard helicopter and the Air Force base on Crete. All this at no small cost to Greek taxpayers—the 200-foot Navy torpedo boat, for example, burned one ton of fuel every hour when under way.

The government also interceded to supply two telephones for the press of-fice—the normal wait for a phone in Greece is up to eight months. Several telex machines and other equipment were also provided to facilitate regular contact with the international wire services and M.I.T.

On April 20, Bussolari's weather reports indicated four days of promising weather patterns coming up; the word went out, and reporters began to drift back. The first two days brought high winds, but Saturday and Sunday looked so good that a full complement of press had returned to the island by Saturday morning. As *Sports Illustrated* observed, "Fate, a native of Greece, was kind to [her] nearest of kin"—by providing a three-knot tail wind on April 23, the first of a two-day rotation for her one countryman among the pilots.

While a few members of the press boarded the Greek Coast Guard vessel to view the takeoff from the water, most waited to see it from land and then left on the official press conveyance, the Navy torpedo boat. National Geographic had hired its own small yacht from a boatyard that had no boats available . . . until a million drachmas was mentioned; NOVA had found a 30-foot

Continued on page MIT 19



savings.

Nobel-Studded Launch in Los Angeles

A penny saved is a penny earned, we all learned in childhood. But a penny saved may also be a boost to the U.S. economic position in the world market, Nobel Prize-winning economist Robert Solow told a group of alumni recently in Los Angeles.

Solow, who holds the title of Institute Professor in the Department of Economics, told about 90 graduates and guests gathered May 15 at the Hughes Aircraft Company's Corporate Headquarters in celebration of M.I.T.'s Campaign for the future that the country's economic position is, in part, related to its low rate of personal

"There are only three things that can happen to the pooled savings of the country: It can find a home financing the government deficit, it can find a home financing private investment in the United States, or it can find a home financing net exports—buying assets abroad," he said

According to Solow, people in the United States annually salt away only about 7 percent of the gross national product (GNP). About 5 percent of the GNP is needed to finance the federal deficit alone, leaving only 2 percent for all other investment.

"We do not save enough to finance sufficient capital formation to make our own economy grow in productivity and efficiency, and that is a large part of our current problem," he said.

Solow attributed the savings drop in part to increased feelings of long-range security that accompany the improved economic circumstances of the elderly and the widespread availability of health insurance and other insurance against catastrophic occurrences. "In other words, you can no longer encourage young people to save for old age or for a 'rainy day,' " Solow said. In Japan, where the private savings rate is triple that of the United States, there is no social security system, he pointed out.

While Solow assured the audience that no one would suggest restoring anxiety about the future as a way to induce savings, he said that we should be seeking other incentives.

"It is not easy to find public policy ways to induce people to save," he said, noting that increases in savings interest rates and even the invention a few years ago of the Individual Retirement Account had little effect on the rate of personal savings.











A third factor in the reduced rate of savings, Solow said, is the easy availability of consumer credit in the United States, a situation that could be altered by changes in public policy. He also thinks the country should consider shifting the main tax base from income to expenditure.

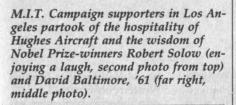
Solow's talk was a part of a symposium titled "Perspectives on the Future" that also included addresses by another Nobel Prize-winner, biomedical researcher David Baltimore, '61, professor of biology and director of the M.I.T.-affiliated Whitehead Institute for Biomedical Research; and by Cecil and Ida Green Professor of Physics Robert Birgeneau. The symposium was moderated by Provost and Professor of Chemistry John M. Deutch, '61.

Baltimore briefed the audience on biomedical research in progress, with particular emphasis on advances in the battles against cancer and AIDS. (A new, self-contained, 700,000-square-foot facility devoted to research on the latter was scheduled to open at Whitehead the following week.) Baltimore characterized AIDS as "the scourge of these decades—the worst natural surprise that we have had in modern times."

He said that the difficulty in finding the key to its cure or prevention lay in the fact that, as a virus, AIDS is not a good candidate for treatment by antibiotics; at the same time, as a disabler of the immune system, it does not readily lend itself to prevention by vaccines, which work by stimulating immunities.

While holding out little hope that the problem will be solved within the next decade, Baltimore added that the medical world was far better prepared to deal with AIDS around 1980, when it surfaced, than it would have been 20 years earlier, before cancer researchers had made some basic theoretic advances. "If AIDS had appeared in 1960," Baltimore said, "we would have been helpless. Then, we did not have the intellectual or technological tools to isolate the virus, to characterize the virus, or to develop the diagnostic tools that we have developed. We would have seen an unprecedented mass hysteria."

Birgeneau gave what he termed "a semitechnical talk" on superconductivity, culminating with a close-up demonstration of how superconductivity works, as he invited the audience to practice levitating a magnet. To illustrate the excitement that rapid progress in the field has generated, Birgeneau exhibited a Japanese comic



book explaining superconductivity partly in the words of Benjamin Franklin, who is shown expounding in Japanese on

the principles of electricity.

Noting that the achievement of superconducting at room temperature "could take place next week, or it could take place five years from now," Birgeneau said that there is "no simple or obvious reason this cannot be done." The potential commercial applications of such an achievement would be limited only by the imagination, he added. Considering that the most visible—and quite unpredictable—uses of lasers have been for supermarket cash registers and compact disc players, Birgeneau quipped, "My bet for superconductivity is that the most money is going to be made in a superconducting GI Joe doll."

The symposium at Hughes, hosted by the Greater Los Angeles Committee for the campaign, was chaired by Frank S. Wylie, '21, and William E. Leonhard, '40, with Samuel Lunden, '21, as honorary chairman. The program included a dinner at which Deutch updated the audience on curriculum changes at the Institute.

Noting that the changes in the curriculum reflect "a substantial qualitative change in the way we view the role of technology in society," Deutch said that the Institute is undergoing a "rebalancing" to meet its ultimate objective better. "The objective of undergraduate education," the provost said, "is extremely easy to state: It is to maximize for individuals the personal fulfillment that they will have during their lives and the potential that they will have for professional accomplishment...In my opinion, that requires a more diverse entering student population, it requires a broader curriculum, and it requires an intellectual climate that fosters attention to values and to...the widest range of activity in our society that bears on technology."—Theresa Pease

THERESA PEASE is the editor of Spectrum, the special Campaign for the future publication.



Continued from page MIT16

"The best part of Steer Roast was that people stayed up all night, talking and drinking beer," remembers Pat Eden. As always, some house residents stayed up the night before to keep vigil over the steer, which cooks for 20 hours in the middle of the courtyard. Others got up early to take over Walker Memorial kitchens and cook the rest of the meal. Between running the show and sneaking off to type thesis pages, they probably didn't have much time to talk, but they can always come back as alumni.

No one knows exactly how many alumni/ae showed up; but some 68 of them, from Michael Potash '66 to a score of '87s, had signed an impromptu guest book at the Senior House desk. Some of them had never even lived in Senior House. But those twentysomething couples talking baby names and real estate know that Steer Roast is the place to find out who's leaving M.I.T. for Rutgers (see above), who's hanging out in Boston and applying to medical school (Chris Tocco, '88), who's writing popular books on software (Paul Hoffman, '79), who's starting a recording studio (Monte McGuire, '83), who got arrested (sorry, to learn that you'll have to attend yourself), who's still following the Grateful Dead (space prohibits publishing the list), and other news you don't usually find in the class notes of Technology

Remember, it's the first weekend in May, and Senior House does not take American Express. □

In a note appended to her article, Diana wrote: 'Incidentally, there's probably as good a story in every living group: Next House has its own musical theater company, the language houses go back 20 years, the coed fraternities had a long struggle to change their all-male status, and there must be a whole book in the Bexley House antics of the 1960s and '70s.'' Surely there are a few amateur oral historians in that crowd who would like to try their hands at writing for the Review.—Ed.



Continued from page MIT 17

launch from which to film the footage for a program to be aired November 22.

The flight went more smoothly than anyone had dared hope, and-with the tail wind—a good deal faster as well, upending the plans of reporters. Because the Navy torpedo boat was too large to land on the beach, a deck-todeck transfer had been arranged to move the journalists to a smaller boat. But the second vessel was an agonizing 10 minutes late in arriving, and the photographers and reporters watched helplessly as Kanellos Kanellopoulos pedalled ever closer to Perissa beach. At the crucial moment a Zodiac rubber raft came by that could handle two reporters at a time. According to M.I.T. News Director Ken Campbell, at such times it is not women and children but wire services who take precedence. The reporters from AP and Reuters were rushed ashore to greet Kanellopoulos, and they provided much of the international coverage of the landing.

The fishing boat that finally arrived to transfer the journalists could itself not go to wading depth, so another Greek fisherman in a rowboat was drafted for the final distance. Meanwhile, Kanellopoulos was encountering shoreline head winds in his attempt to land half a mile farther down the beach. As a result, few journalists were able to join close to a thousand residents of Santorini and tourists on the beach to welcome the dripping pilot after the plane's spectacularly graceful collapse into the

sea 30 feet from shore.

But no matter. The following morning Sunday editions around the world carried the news, frequently on the front page. Clearly, as Daedalus' creators had foreseen, an equivalent trip from Grand Bahama Island to West Palm Beach would not have gripped the collective human imagination in quite the same way. Sports Illustrated devoted a luxurious five-page spread to the event, and the August issue of National Geographic carries a story; Time gave it a page, and Life incorporated its table of contents onto a double-page, wingtip-to-wingtip photograph of Daedalus swooping over the Aegean.

From now on the name Daedalus will evoke two meanings—of a myth and a dream that, defying earthbound limitations, came true.—Faith Hruby



Bringing Iranian Grads Together



ife in the United States can be particularly stressful for Iranian expatriates. Their sustaining sense of pride in their native country and culture is subdued by events back home, the animosity exhibited in this country toward Iran, and the current situation in the Persian Gulf. And although the number of U.S.based Iranians is considerable, as a consequence of that country's earlier encouragement of advanced education abroad for its citizens, their desire to keep a low profile has discouraged the natural impulse of an immigrant community to form cohesive and mutually supportive groups.

So when the organizers of the first annual Harvard-M.I.T. Reunion for Alumni and Faculty Affiliated with Iranian Culture set out to create a database, they didn't have an easy time of it. Country of origin is not always evident on alumni rosters, but they did manage to compile a list of 546

names and addresses. Of those, more than 130 assembled in late April for a day of talks, a banquet, and a presentation on Persian art and research projects. They also adopted a charter making the group an ongoing association.

Although the sessions fulfilled their goal of being informative rather than political in focus, the shadow of political events hung over much of what was discussed. Most Iranians living abroad have compelling reasons for not wishing to return home at this time. They are nostalgic for the strong and ancient culture they have left behind (although as architect Nader Ardalan remarked, they carry much of it with them), and have given a lot of thought to the factors that caused the success of the recent revolution.

Although many Iranians living in the U.S. are privately critical of the prevailing ideology and current events in Iran, it is painful for them to appear to be contributing to the denigration of their country. This is compounded for the many who are devout Muslims by the Ayatollah Khomeini's interpretation of Islam: he states that those who are themselves truly devout would not be living in the United States, because Western culture is antithetical to Muslim beliefs.

An alumna in the audience commented on the difficulty of instilling in her children a pride in their Iranian heritage when faced with a steady dose of anti-Iranian sentiment and what the Iranians perceive as the

distortions in the Western media. But she and her colleagues had few solutions to offer on ways to provide a more balanced picture for the American public.

Several of the speakers had done extensive statistical studies of things Iranian: a geographical and occupational survey of alumni collected on the database, a case study on Iranian immigrants in the U.S., and the modern history of education in Iran.

Since a large percentage of Iranians came to this country for advanced educations, unlike some immigrant populations, they tend to be less dependent on each other and thus are more spread out across the country. However, it is interesting to note that one in five Iranians in the U.S. lives in the L.A. area, and the Beverly Hills school system is 25 percent Iranian.

'Iran is beyond what is today-it is an eternal message," said Nader Ardalan during an eloquent slide presentation interweaving Persian design and philosophy. Using ancient rugs and Islamic architecture, he showed how basic art forms derived from the depiction of central Persian symbols such as the paradise garden and the universal man. The border on Persian rugs, for instance, divides the carpet into inner and outer gardens: the inner symbolizes strength to allow survival in singularity; the beauty of the outer garden is a sign of the beauty held within individuals. Ardalan portrayed a profound and tranquil ethos that was in striking contrast to the image of Iran familiar to most Western observers.

In the eyes of Persian expatriates, their adopted country can be by comparison plastic, plain, and materialistic, and the American view of their homeland as a nation of irrational and bloodthirsty fanatics is equally galling. These M.I.T. and Harvard grads seem to derive their strength from a deeply engrained intuitive and spiritual outlook that they are integrating with the empirical, more quantitative approach of the professions they have chosen to pursue in the West. They project a view of Islam broader and more open than the one espoused by the current Iranian leadership.—Faith Hruby 🗆



[Any Iranian alumna/us of M.I.T. and/or Harvard who did not receive a conference mailing is not on the database. To receive future mailings, please send name, address, and degrees to:
HMIAA

c/o M.I.T. Alumni Association 201 Vassar Street, W59-200 Cambridge, MA 02139]

Corporation: New Members

hen the M.I.T. Corporation gathers on October 7 for its annual meeting, five of those present will be alumni joining the Institute's governing body for the first time, and five more will be alumni returning with new credentials.

Elections at the Corporation meeting on May 27

included:

☐ Joseph G. Gavin, Ir., '41, former president and chief executive officer of Grumman Corp., and Mary Frances Wagley, '47, former executive director of Episcopal Social Ministries of the Diocese of Maryland, Inc., named life members.

☐ Herbert H. Dow, '52, vice president of Dow Chemical Co., and Robert A. Charpie, chairman of Cabot Corp., re-elected to five-year term

memberships.

☐ Angus Ñ. MacDonald, '46, president of Angus MacDonald and Co., Inc., Greenwich, Conn., and Frank S. Wyle, '41, founding chairman of Wyle Laboratories, El Segundo, Calif., elected to five-year term memberships following terms that expired in 1987.

☐ Margaret Coleman Haas, '50, consultant in food technology, West Lafayette, Ind.; David H. Koch, '62, executive vice-president and director of Koch Industries, New York City; H. DuBose Montgomery, '71, general partner in Menlo Ventures, Menlo Park, Calif.; and Robert A. Muh, '59, independ-



I.G. Gavin



M.F. Wagley



M.C. Haas



D.H. Koch



H. DuB. Montgomery



R.A. Muh

ent investment banker, San Francisco, elected to the Corporation for five-year terms on nomination by the Alumni Association.

☐ Megan J. Smith, '86, elected to a five-year term on nomination by graduates of recent M.I.T. classes. Smith received a master's degree in mechanical engineering in May; her plans for 1988-89 aren't definite.

Gavin and Wagley have long records of service to M.I.T. Gavin has been a member of the Corporation since 1983 and its Executive Committee since 1984. He is a founding member of the M.I.T. Sustaining Fellows, a member of the Corporation Development Committee (since 1973), and a major participant in the M.I.T. Leadership Campaign (1975-80) and the current Campaign for the future. Gavin was president of the Alumni Association in 198687 and received its Bronze Beaver in 1982.

Wagley was first elected to the Corporation in 1970 and since then has served two more five-year terms. She served on the Executive Committee from 1973-75 and resumed her work on that body in 1987. She was the first woman to be president of the Alumni Association (in 1984-85) and was honored with a Bronze Beaver in 1981.



I want very much to get in touch with widows or descendants of the Class of 1905. If anyone knows of the whereabouts of such people, please write to me, G. Edwin Hadley, '38, at: 50 Spofford Rd., Boxford, MA 01921.

We regret to report the passing of three of our classmates: Joel Connolly (92) in January, Fred Kenney (95) in February, and Charles Reed (93) in April. We're grateful to have shared so many years with them. Millie and Charles Reed attended most of our annual and five-year reunions. Joel attended many of the five-year reunions. Each of the three had distinguished careers including tours of duty in the military service of the United States. Millie Reed noted in her recent letter: "Charles ever held his classmates in great affection. He was proud of M.I.T. and the many men who contributed so much when called to serve our country in so many different capacities, civilian or military, during war and peace.

Joel Connolly had a long and distinguished career in public health work. His daughter, Ruth Connolly Kvaalen, sent us a memorial tribute to Joel from which we quote: "He served in the U.S. Public Health Service from 1918 to 1926 and was in active military service in World War I. From 1919-20, he was chief sanitary engineer of the Near East Relief, working in Middle Eastern countries to control post-war diseases such as cholera and typhus. He worked at the Chicago Board of Health for 27 years, as chief of the Bureau of Public Health Engineering from 1925-1936 and as assistant to the president from 1936 to 1952. In the course of his work, he discovered the source of the amebic dysentery outbreak during the 1933 Chicago World's Fair and, in the same year, a common but faulty plumbing connection that had been a source of contamination of sterile water in hospital operating rooms. His redesign of the plumbing was subsequently adopted worldwide. In 1952, he was sent abroad by the U.S. Foreign Service, first to the Philippine Islands, from 1952 to 1955, then to Taiwan from 1955 to 1961. In these countries, he engineered and supervised the building of pure water supplies and related public health matters.

During retirement years, he gave many illustrated lectures about various places in the world he had visited or lived in. Traveling and learning about other cultures always interested him, and he made five trips around the world by different routes during his lifetime. As a member of Rotary International, he held a perfect attendance record for over 20 years and attended meetings on all five continents."

Thanks for sharing with us your lives. Please write.-Bob O'Brien, Acting Secretary, 25 Keith Rd., Pocasset, MA 02559

18

At this writing, it is May 15, 1988, and our 70th M.I.T. reunion takes place on June 3. About a month ago, I had an idea we could capitalize on our 65th reunion-invite classes graduated before us and the four after us to join with us and enjoy a three-day program with speakers, bus tours, and meals for a celebration much worthwhile. Five years ago we had about 25 celebrants. As of today, only Rhoda and Charlie Tavener are coming up from Florida, Tom Knowland from Belmont, and Selma and myself. We have called off our grandiose plans and will participate in the M.I.T. Technology Day program. I hope more of you will be with us.

A bonus is available two days later when the Cardinal and Gray Society will meet at Endicott House with the speaker M.I.T. Professor Philip Khoury. He will speak on "The Palestinian Uprising, Its Origins and Implications." You will recall that these meetings are the outgrowth of our mini-reunions at Endicott House.-Max Seltzer, Secretary, 865 Central Ave., Needham, MA 02192; Leonard I. Levine, 519 Washington St., Apt. 15, Brookline, MA 02146

I am happy this writing to report no deaths, so the total living members stands at 43.

The other evening when sharing a TV program with Florence, there on the screen stood Bob MacMullin. It was a treat for both of us, as it may have been for some of you. Bob was on a program dealing with poisonous gas in the military. Good work, Bob. Meanwhile, in many schools, class reunions are in the headlines. Your committee for 1919's 70th reunion-George Michelson, Doc Flynn, and Don Way-are alerted, and before long each member of the class will receive a notice containing our thoughts and

Now do have a good summer. I would enjoy a word or more from any classmate.-W.O. Langille, Secretary, P.O. Box 144, Gladstone, NI 07934, (201) 234-0690

Bill Forbes of New Bedford, Mass., died on February 14. After graduating from Dartmouth, he came to M.I.T. for a S.B. and master's degree in chemical engineering. He was a 50-year member of the American Chemical Society. He served as chief chemist for the New Bedford Rayon Co.

Through his son, Bruce, I was notified of Malcolm Lees' death last April. Mal lived in Ridgewood, Conn. His wife, Connie, '21, died several years ago. I used to be neighbors of theirs when they lived in Winchester and had many pleasant meetings with them. Mal was a true son of M.I.T. and a loyal classmate. We shall miss him.

It's too early to report on class attendance at

Technology Day. At present, I can record that Buzz Burroughs and Frank Maconi will be on hand, and hopefully others.-Harold Bugbee, Secretary, Apt. 702, 3 Rehabilitation Way, Woburn, MA 01801

Your secretary received a nice phone call from Helen St. Laurent in late April. She said she was doing well. She had been talking to Cac Clarke recently and learned he was flying to Boston to attend Technology Day this June 1. Since his slight stroke last year, Cac has not been driving, and Maxine does not drive either.

Alumni Fund envelopes from two classmates brought in tidbits of news. Dr. Kenneth Bates of Canton, N.Y., reports good health for his age drives his own car, and visits numerous children, grandchildren, and great grandchildren living all over the United States. . . . Eugene Hardin of Manhattan, Kans., says he is more or less retired at age 92, but takes on special assignments by

Parsons, Brinkerhoff to keep active.

There is one death to report this month: John G. Lee of Mystic, Conn., who died on April 7, 1988. John had a distinguished career, starting with a year of teaching aeronautical engineering at M.I.T., working as project engineer for Ford Motor where he was one of six men to design the Ford tri-motor plane, and later joining United Aircraft to become director of its research department. He was a founder of the University of Hartford and served as the first chairman of the university's board of regents.-Sumner Hayward, Secretary, Wellspring House E64, Wash. Ave. Ext., Albany, NY 12203; Samuel E. Lunden, Assistant Secretary, 6205 Via Colinita, Rancho Palos Verdes,

William B. "Bill" Elmer is still hard at it. Recently he was granted a U. S. patent on a pendulum in which the bob is horizontally pivoted at its center of gravity to eliminate rotation of the bob as the pendulum oscillates. It requires less energy to drive it, making lighter springs and clockwork possible. Bill says, "I had to work out the new time equation for it, which I did thanks to my former mathematics professor, the late Norbert Weiner." Bill's patent lawyer says this is the first change in the pendulum since Sir Isaac Newton. Bill is also author of The Optical Design of Reflectors, which has gone into worldwide circulation, and he has been invited to go to China with a way stop in Japan on the People-to-People scientific interchange program started by President Eisenhower. To keep in shape, Bill is still mowing the lawn at his home in Andover, Mass. and around his 100-acre tree farm in Thornton,

George G. "Peg" Marvin, age 88, died in Fort Myers, Fla., April 10, 1988. Born in Jacksonville, he came to Tech after serving in World War I. He

was one of only a few of our classmates who continued his studies to earn his S.M. and Ph.D. at M.I.T., where he then taught chemistry for 23 years. He worked on the Manhattan Project during World War II and joined the Atomic Energy Commission in 1948, where he was assistant director of the Raw Materials Division. He retired to Fort Myers in 1959 and was active in the Men's Garden Club for many years. He was a member of the Presbyterian Church. Survivors include his wife, Cora, of Fort Myers; a daughter, Corinne M. Schultz, of Fort Myers; a sister, Margaret Dupertuis, of Jefferson, N.H.; a grandson and granddaughter, three great-grandchildren. We extend our sympathy to the Marvin family.

Your secretary, having substantially recovered from the attack of polymyalgia rheumatica he suffered four years ago, expects by the time you read this to be playing a little golf again, with the outside hope of just possibly shooting his age. Yardley Chittick, Secretary, Box 390, Ossipee, NH

Robert Armstrong died September 13, 1985. After graduating in civil engineering, he joined the New England Telephone and Telegraph Co. and became a project engineer. His hobbies were pho-

tography and bird carving.

Capt. Frank Bunting died December 17, 1986.

After studying at the Institute and at New York University, he became an office manager for New York Telephone Co., then district manager for General Motors Corp. He then established the Bunting Co. and became president and treasurer. He served in the U.S. Army in World War I and II. He was also an active member of A.F. and A.M. and post commander of the American Legion. He enjoyed bowling and golf.

Col. Nicholas Kane died December 5, 1977. He studied courses in civil engineering while at the Institute. In 1962 he received a B.S. in industrial engineering from Columbia University. He was an engineer with the city of New York. From 1941 to 1955, he was in the U.S. Air Force and served in the United States, Australia, New Guinea, the Philippines, Greenland, Libya, Saudi Arabia, and the Air Academy. He enjoyed fishing and was interested in art, travel books, and old maps. Richard H. Frazier, Secretary, 7 Summit Ave., Winchester, MA 01890

A note from Douglas Montgomery, an electronics engineer in southern California, tells of a couple of hospitalizations this past year from which he is recovering. He is retired and living in a senior citizens' complex. His address is 4900 E. Telegraph Rd., Ventura, CA 93003.

We have learned of the death of Winthrop L. Warner at Vero Beach, Fla., last November. His home before retiring as naval architect and yacht broker was Middleton, Conn., where he was born. Apparently it was a yachting paradise for him. He had served as commodore of the Yacht

Club.

Paul L. Sharkey died last February. He graduated in civil engineering and became a planning engineer for the U. S. Bureau of Reclamation in Amarillo, Tex. He is survived by his wife, Marceline. They were living at King George Dr., in San Antonio.-Rock Hereford, Co-secretary, Hacienda Carmel #90, Box 5397, Carmel, CA 93921, (408) 625-7590; Russ Ambach, Secretary, 434 Jamaica Way, Boston, MA 02130, (617) 524-6069

Archer Nickerson reports in from Duxbury, Mass., and says his happy family continues to expand. He has four great-grandchildren with another expected. It seems to Arch that these lit-



A new eight-oared shell, christened "Lightweight Varsity 1926-Winners H Y P," joined the Pierce Boathouse fleet late last spring. The Christening was by Malcolm Greer, '26 (left), with help from Cedric Valentine, '26- both members of the 1926 lightweights. And when you ask about why the "HYP," they smile: you were meant to ask. The new shell commemorates a crew that was victorious in a single season over Harvard, Yale, and Princeton.

tle people are smarter than those he remembers in the preceeding two generations. . . . Finley Laverty writes briefly, "Consulting engineer, international practice. Retired 1981."

The passing of three classmates must be reported. Masaru Kametemi died of leukemia on October 11, 1987. Those classmates who have attended more recent reunions will remember Kamy with affection. The first reunion he was able to attend was the 40th, but every five years after that he appeared, on two occasions with his wife Hisako. While at the Institute, Kamy had a home address in Los Angeles, where he prepared at USC. Upon graduation, he returned to Japan where he was employed throughtout his working career. He is survived by his wife, Hisako, and a son, Masaro.

Michael S. Lespassio of Revere, Mass., died at the Melrose-Wakefield Hospital on March 31, 1988. He had attended Tufts University and Suffolk University Law School as well as M.I.T. He was an engineer with the Massachusetts Department of Public Works for 44 years. He was a member of the Massachusetts and American Bar Associations. He was also a former vicepresident of Local 780 of the State Engineers Union and former president of the Revere Nest of Orioles. He leaves his wife, Lillian A. (Vesco), two sons, two sisters, four grandchildren, and one great-grandchild.

Theodore F. Plimpton passed away in Albuquerque, N. Mex., on March 18, 1988. He had graduated from Wesleyan University in Middletown, Conn., before coming to M.I.T. He taught at Phillips Academy in Andover, Mass. and in 1924 went with the Inland Steel Co. in Indiana Harbor, Ind. After 41 years, he retired from Inland as the assistant to the vice-president for manufacturing and research. He was a lifelong supporter of the Boy Scouts of America and received the Silver Beaver award. He was also active in numerous professional societies as well as civic organizations such as the Chambers of Commerce, Elks, Kiwanis, and Lions in East Chicago and Schererville, Ind. He had lived in the Calumet, Ind., area for 60 years before moving to Arizona in 1986. He is survived by his wife Dorothy,

a brother, two sons, four grandchildren, and three great-grandchildren.—F. Leroy "Doc"
Foster, Secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

Howard Humphrey died last March 29. Because he attended our reunions regularly, we were able to renew our friendship over the years. For 36 years before retiring in 1970 he worked in the Employee Relations Department of Du Pont Co. Knowing Howard, he must have been a big help to Du Pont in keeping employees happy and productive. He was active in many organizations, including a lifetime membership in the Boy Scouts. A real loss to his wife, Virginia, two sons, a brother, and three grandchildren.

One of the last contributions for the class of '26 is Bill Meehan's autobiography including information about many of our classmates. Bloomis III of Roscommon, Mich., and lately of Simsbury, Conn., and Ithaca, N.Y., left us last August 31. He was a sailor from age 6 until a week before his death. His naval-architect father inspired him at an early age to design and build boats. At General Motors he worked in creative and sophisticated design, gaining 13 patents. He was active in many organizations, and tutored the underprivileged in Royal Oak township and Pontiac, Mich. He was editor of Voodoo at Tech and engineered the design of kites. He made friends in minutes and had strong family ties. His grandson, Nathaniel Calvin, '90, is currently at Tech.

Leo Teplow, now of Arizona, has written a book entitled Regulating Safety and Health, a Working Model, published this year by the American Society of Safety Engineers.

Coming to all our reunions, including the 57th, was Louis R. Taylor and his wife Ruth. "Living in Bethlehem, Pa., enjoying my retirement and working in my garden. Just back from Washington, D.C., where we took part in the Colonial Clergy Society, and the Colonial Dames and the DAR for my wife, Ruth. Great being part of '26." Ruth writes, "We are celebrating 58 years of

In Tribute to James R. Killian, Jr. '26

By Bill Moyers

Some 800 people took time on May 5 to share a memorial for James R. Killian, Jr., '26, in Kresge Auditorium. The tributes, delivered by many of the most distinguished figures at M.I.T., were both eloquent and emotional. They made those of us who arrived at M.I.T. too late to work with Killian envy colleagues who had personally experienced his leadership and friendship.

Although he was the only speaker who was not a member of the M.I.T. community, journalist Bill Moyers clearly understood, and captured in his words, the character that made Killian a giant in the history of this institution. And because his was a voice and a perspective on Killian that was new to the community and to readers of the Review, we selected his tribute to reprint to mark the occasion. His text follows.—S.L.

They were an odd couple. One graduated from America's preeminent citadel of science, the other from Southwest Texas State Teachers' College. One walked comfortably among intellectuals, the other prowled the back rooms of power like a hungry lion. One had the face of a cherub, the other looked as if he had just cut the deck to give himself three aces. One spoke softly and modestly to win agreement, the other wheedled and pummeled until he exhausted the opposition. One grasped the concepts of radar, computation, and missile guidance systems; the other was a genius at quorum calls, motions to recommit, and pork barrels. Only a clever trickster could have contrived a more unlikely pair than James Rhyne Killian and Lyndon Baines Johnson.

But it was their fortuitous collaboration that brought formally into existence our public broadcasting system. "Television," said James Killian, "should enable us not only to see and hear more vividly but to understand more vividly." "The time has come," said Lyndon Johnson, "to enlist television in the cause of education." It was to both of them more than light and wires in a box.

Seeing them at White House meetings, one was less taken by their palpable differences than by the savvy that each brought to high public policy. Both were smalltown boys—one from the Deep South, the other from central Texas—who never forgot that the best way to get your way is to let other people think they are giving it to you. They had known each other when Lyndon Johnson was Senate majority leader and Mr. Killian was science adviser



to President Eisenhower and each had championed America's advance into outer space.

LBI was impressed. Here was a man like himself who believed in building consensus beyond partisanship, but who did not need to raise his voice to be heard. Here was a man of science who had pushed for more humanistic studies at M.I.T. Here was a man who understood the new technology of broadcasting and believed that its power to move image and sound could be coupled with the power to move mind and spirit. Here was a private man who had become the model of the public trustee. Who better to persuade a skeptical Congress of the need for a governmentfunded broadcasting system that would be free of the tyranny of advertising and the mass audience without falling victim to political pressure?

Legacy of Gentle Persuasion

The idea for a public broadcasting system was discussed in meetings at the Department of Education in 1964. One year later Mr. Killian became chairman of the Carnegie Commission on Educational Television, which prepared the way for the Public Broadcasting Act of 1967 and the establishment of the Corporation for Public Television. Dig through the records of those proposals, proceedings, debates, and final enactment of the recommendations, and you will understand the legacy created by the gentle persuasion of James Killian.

As president of M.I.T. he had championed diversity in an age of specialization. He called for an ecumenical spirit to recognize that "the fabric of our culture is weakened if any of its strands-science, technology, the humanities, social studies, religion—are not at full strength." Now he called for a public broadcasting system that would become "an expression of American diversity," one that would bring us "a fuller awareness of the wonder and the variety of the arts, the sciences, scholarship, and craftsmanship." He believed that television should have a moral code—that it should seek to dignify life and not debase it: that it was in fact a moral transaction: if you give to it an hour of your life-an irreplaceable hour of unrepeatable life—you should get back something of

I think he would have agreed with Saul Bellow's itinerant correspondent, Herzog, who said that "the people who come to evening classes are only ostensibly after culture. Their great need, their hunger, is for good sense, clarity, truth—even an atom of it. People are dying (it is no metaphor) for lack of something real when day is done." To James Killian, public television could become the largest evening class of all.

Because he wanted us to stand for something, he became an unrelenting proponent of public affairs programming. In 1973, when Richard Nixon and Spiro Agnew were trying to eliminate public affairs from public television as one step toward destroying the system altogether, our

house was bitterly divided by internal factions that made us all the more vulnerable to predators. The directors of the Corporation for Public Broadcasting, which six years earlier he had tried to insulate from just such political meddling, now called their patriarch down from Boston and elected him chairman of the board.

His first action was to call for a "declaration of peace" to end the internal warfare within public television, and then to scuttle the White House gang that was clambering aboard ship with political larceny in its heart. That crowd wanted no public broadcasting at all, but if there were to be one, let it reflect only the official view of reality: that war is peace, lies are truth, and everything else goes down the memory hole.

Some of Mr. Killian's fellow directors had been willing to buy a truce; they would surrender public affairs programming for guaranteed federal funding. No, said Mr. Killian, it is simply unacceptable not to have national public affairs programming on the nation's public television. And he prevailed.

In the Image of His Aspirations

Over the years some of us have produced programs that occasionally countered the official reigning wisdom. My most recent was a special last fall called "The Secret Government," which looked at the growth of that cancer on the Constitution whose latest manifestation appeared in the Iran-Contra hearings. If James Killian had been a lesser man, unwilling to risk prestige and position for principle, the freedom of public broadcasters would have been diminished and our country's faculty for self-scrutiny and self-correcting action would have been undermined further.

The first presidential adviser on science was no scientist, but he opened public policy to the vistas of science. The architect of public television was no broadcaster, but he opened our eyes to the more humane possibilities of the medium. We who work in its vineyards have fulfilled his expectations only modestly, but that we have done so at all is the result of having been created in the image of his aspirations.

Television journalist BILL MOYERS was the press secretary for President Lyndon B. Johnson. He is now associated with Public Affairs Television, Inc.

r. Killian believed in the grand design of this institution and he spent his full energy, formidable intelligence, and unique spirit in its service. The Institute was his life. It sustained him and gave him a deep well of support and endurance. . . . He reciprocated by bringing an enormous talent, unusual ability, and unsurpassed love to this place."—Howard W. Johnson, President Emeritus and Honorary Chairman of the Corporation

Jim [Killian] had a rare quality—the ability to remain quiet in the midst of a windstorm of words until he had something really useful to say, which he inevitably did. Waiting for Jim's assessment was an important feature of any group decision-making task. . . . He moved with such grace and ease and little fanfare that his gifts were never fully tallied. But his monuments are all around us, constant reminders of this wonderful human being who never stopped wondering and doing."—Jerome B. Wiesner, President Emeritus

Ithough he had no advanced degree in science or technology, [Dr. Killian] understood, more than those who had such degrees, the deeper meaning of these subjects and their intimate relations to society. He showed the dignity of true leadership by acting as a loving gardener, assuring that the right plants in his garden had the means and the environment to grow according to their inner drives. This is the ideal kind of leadership for the head of a university. It implies a great deal of wisdom and discernment, the gift of recognizing the special abilities of people, and a modesty that goes with a great character."—Victor F. Weisskopf, Institute Professor and Professor of Physics Emeritus

The life of [James Rhyne Killian, Jr.] was filled with honor and accomplishment, the man with wit and wisdom. He was, and is, M.I.T.'s very own—the first alumnus of the Institute to serve as its president. He was its devoted servant and inspirational leader. Shaped by M.I.T., he in turn shaped it; . . . more than six decades, each formed the other."—David S. Saxon, Chairman of the Corporation

to the last weeks of his life, and his personal influence on this special place is both extraordinary and quite singular.

. . . He had a remarkable capacity to present the case for M.I.T.—its opportunities and its needs—in terms that were both comprehensible and compelling. His ability to fire a donor's imagination and appeal to his or her sense of responsibility for large and important causes was unmatched. My apprenticeship left me with a keen appreciation of the admiration, wonder, and pleasure Cecil Green had for Jim Killian when he said, 'He was my most expensive friend'.''—Paul E. Gray, '54, President

marriage."

The memorial service for **Jim Killian** was out of this world—about 50 members of the Tech Orchestra and nearly 50 in the chorus, six speakers,

followed by a reception.

Our vice-president turned president, Robert Taylor Dawes and wife Evelyn write: "Felt that this service really exemplified Jim in deed. This was very difficult to do so well and certainly was a tribute to M.I.T." . . . Ruth and Ben Margolin write: "Much impressed by the broad aspect of Jim's impact on the Public Broadcasting Policy as an important force in the search of truth." . . From Ruth and Bob Dean: "When we roomed together, Jim was noted for his extensive vocabulary. Preparation for his great career."—Donald S. Cunningham, Secretary, 27 Lowell St., Braintree, MA 02184

27

We have a kind letter from **David R. Knox** in Lantana, Fla. He says, "I now carry a cane when I go outside. My second wife, the former Jean Redeker and sorority sister of Dorothy's, is a gem. She takes good care of me and contributes greatly to my social life. Life was pretty lonesome and dull for the three years after Dorothy's demise. We enjoy living in the warmer climate of Florida. This will be the first year we haven't flown up to northern Michigan for a short vacation; air travel is too much of a hassle for us older folks.

"Most of my accomplishments in retirement have been in oil painting. I've lost track of the number—must be close to 100. Our apartment is adorned with 29 of them, and the balance have been given to worthy institutions—our church, two hospitals, my three children, and appreciative neighbors and friends. Our church in Palm Beach, The Royal Poinciana Chapel, has seven hanging in various areas. Our retired minister has one in his home, as does the current minister. My art instructor urges me to have an exhibit in the Society of Four Arts in Palm Beach.

"The publishing of my book, Portrait of Aphasia, and my term as mayor of Huntington Woods, Mich., occurred in the dim past, as well as my engineering career (Bundy Corp.), which produced seven patents and a satisfying cluster of memories.

memories

"Other than diabetes, hearing impairment, glaucoma, and having survived two convulsive seizures, I am in good health. Three children, six grandchildren, and three great-grandchildren comprise my successor generations. One granddaughter is a mechanical engineer. I have decided that keeping busy is one of the keys to living longer."

Dave is a good example of one who has faced life with courage and determination to find contentment and accomplishment.—Joseph C. Burley, Secretary, RFD 1, Epping, NH 03042; Lawrence B. Grew, Assistant Secretary, 21 Yowago Ave., Branford, CT 06405

28

This issue of notes will fall into something of a silence gap with respect to any specific reunion news. When these printed words are before you, our 60th reunion will be history by a matter of several months, yet they are being written nearly three weeks prior to that event. As we write, there is a good volume of correspondence, but nearly all of it relates to reunion business. However, there does come an occasional bit of news.

David Ingle's memories of M.I.T. seem to him "just like yesterday" even though he knows well that 60 years is a very long time. Although feeling not quite up to making the long trip from Indiana to Cambridge, David sends his best wishes for those who are attending and included a thoughtful contribution as well. . . . After making

very definite plans to be with us in Cambridge, Jim Rae had to cancel out when a family wedding cropped up in conflict with the date. . . . Al Gracia plans to move into a new retirement facility local to his present home in Connecticut. His future home is still under construction, and he is very busy preparing for the move. All this has pre-empted his plans to be with us in lune.

Bob Hunn, who appears to be one of the most eager of attending classmates, will not only arrive in Cambridge a day early but will bring with him a son and grandson—and all the way from California and Texas! . . . Gabe Disario is coming from Venezuela for reunion and will be joined on campus by his grandson Gabriel, who will come from his home in Denver, Colo. . . . Ellen (Mrs. Dean) Batchelder must easily rate as among the bravest of those registering. She is traveling from her home in California in the company of daughter Linda to attend a part of reunion activities, then on to visit with relatives on Cape Cod. Five years ago she and Dean enjoyed the 55th together.

Along with Ted Zavorski's registration form, there came a mildly apologetic letter saying that he has not reported on his activities since graduation. Then follows a thumbnail sketch of his professional life beginning as a field engineer for Majeski and Masters, then progressing through a career of building major bridges, dams, sewage treatment plants, power plants, flood control dikes, ski areas, and buildings (including some at M.I.T.). His later professional years were with Daniel O'Connell Sons, Holyoke, Mass., as chief engineer and board member. Ted remains active with his company. He and wife Adelaide still enjoy sking—one of his ski slopes has been named for him (who else of us has such a lasting monument!?).

We regret to report the death of William J. Sweeney on March 30, 1988. Bill received his Sc.D. degree (Course X, chemical engineering) as a member of our class and was known to many as "Doc." Prior to entering M.I.T., Bill had already graduated from the University of Massachusetts and had obtained his M.S. in chemistry at Pennsylvania State University. At the latter, he had also taught chemistry for five years. His industrial career began with Standard Oil of Louisiana and was completed as vice president of research in Esso Research and Engineering Co., New York. During World War II years, he worked on the Manhattan Project and as a consultant for the Royal Air Force. Besides wife Louise, Bill leaves three sons (one of whom is William J., Jr., '55) and two granddaughters. To all of these family members we extend our heartfelt sympathy. Walter J. Smith, Secretary, 37 Dix St., Winchester, MA 01890

29

Malcolm M. Hubbard of Beverly, Mass., writes: "I now live alone in my comfortable apartment here, after I gave away in marriage my grand-daughter, Susan Bentley Hubbard, in September 1987 to Grantley A. Mitchell of Lynn, Mass. My location is central to all my Massachusetts relatives and friends. The rest are scattered all over the U.S." Mal has seven children, 19 grandchildren, and three great-grandchildren. He enjoys listening to music, reading, and woodworking.

Oliver K. Noji of Oakland, Calif., writes: "Since my retirement and loss of my wife in August 1987, I have taken two trips to Japan, having just returned from the recent one. I cherish the wonderful memories of M.I.T., particularly those of my Course X (Architecture). I would appreciate if you send me the names of the surviving members of my course, so that I may correspond with them and find out how they fare, and exchange many pleasant memories and wish them all well."

Hunter Rouse of Sun City, Ariz., writes: "What's new with us? Two weddings of our grandchildren and the birth of our first greatgranddaughter. Otherwise, life goes on as usual.

Doi joins me in sending our regards to all." . . . I received a note from Earle Erickson and wife Marion of Burlingame, Calif.: "The stock market turmoil of last October and the so-called simplified income tax returns keep my mental facilities busy and active.

"Physically, I take long walks and do a lot of gardening. We had assumed that we had reached the limit of five great-grandchildren, but a grandson is soon to be married, which may change the odds for a higher number. We are looking forward to our 60th reunion."

From Paul F. Donahue and wife Fran, from Nahant, Mass.: "We had about four weeks in Naples, Fla., in March. We stayed one week in the Ritz with Paul's sister. We also spent another week in New Orleans for a convention. May will be a busy month for us. Two grandsons graduate, Sean from St. Michael's in Vermont and Paul from Wentworth. Then we have a family wedding and a trip to Norfolk, Va., to visit our navy family, Captain John White, our son-in-law, with Kathy and the children before they take off for duty in other parts of the world. Another grandson, Nelson, class of 1991 at M.I.T., has been busy with dramatic performances and hockey. They will all be visiting us at cool Nahant this summer."

I regret to announce the deaths of the following members of our class: Frederic D. Merrill, Jr., of Chatham, N.J., on January 14, 1988; John C. Macy, of Kinnelon, N.J., on February 8, 1986; and Thomas H. Coe, Jr., of Howey in the Hills, Fla., on March 4, 1988.—Karnig S. Dinjian, Secretary, P.O. Box 83, Arlington, MA 02174

30

This month we have a first report since 1963 from John Parmakian, who with his wife, Adele, lives in Boulder, Colo. After graduating from M.I.T. John obtained an S.M. degree from the University of Colorado and thereafter had a distinguished career with the U.S. Bureau of Reclamation in the Denver area. For the past 25 years he has been a self-employed consulting engineer on worldwide projects (e.g., hydropower, pumping and pumped storage power plants). Last fall he won the A.S.C.E. Rickey Medal for "his illustrious career relating to designing hydromechanical equipment for hydroelectric projects and for his significant contributions to the literature on waterhammer phenomena." His other awards include a Bronze Star for formulating and executing plans for the anti-aircraft defense of Iwo Jima, and a 1969 Distinguished Engineering Alumni Award from the University of Colorado. His book Waterhammer Analysis has been translated into five languages. In his free time, John climbs mountains in Colorado and Switzerland.

Ed Pritchard's retirement home is in Pocasset on Cape Cod, where he and wife Blanche live in Tahanto Colony, a community of about 100 homes. Ed serves on its board of directors and the Road Committee. He and Blanche "enjoy excellent health," swim in Buzzards' Bay, and still make annual spring trips to visit their daughter and her family in London, with side trips to Paris. He reports that the summer of '87 was the "warmest and sunniest in 47 years for both London and Paris," and that they were "much impressed with the transformation of the oldegare d'Orsay into a lovely new museum." couples commenting this month on their continuing good health are the Granger Schraders, the Sol Umans, and the Irving Dows. The Schraders are "nearly full-time volunteers with American Red Cross." Their travels have taken them to all 50 states and include a world tour by plane. They now have 15 grandchildren and two "greats." The Umans shuttle between a winter home in Pompano Beach and a summer home in Hunter Mt., N.Y. They attend ballet and other arts performances in Saratoga, enjoy N.Y. shows in the summer, and play golf and bridge at both places. . . . At the time Irv Dow wrote, he and Ruth

were still living in Silver Spring, Md., but were planning to move to a life-care facility during the summer. They hope to make it to the 60th reunion. Parenthetically, both Grange and Irv turned 85 this year; hence, in my judgment, they are now entitled to treat continuing good health as a news item.

George Perry and his wife, Louise, have also moved to a life-care facility, specifically, Friendship Village in Tempe, Ariz. After George's retirement in the mid-70s, the Perrys lived in Fountain Hills, one of the newer developments in the Phoenix area, from which they moved about two years ago. George says he misses the open spaces and quiet environment in and around Fountain Hills. As an avid stargazer, he is also troubled by the dust and light pollution in Tempe. The main reason for the move was the proximity of healthcare services at Friendship Village. George's professional career and hobbies have been described in previous class notes. He spent his first 20 years out of M.I.T. installing and operating telephone systems in Latin America. In his letter to me he mentioned the rather intriguing fact that he and Louise were married more than 55 years ago in the Cathedral in Cali, Colombia. Since they were both Protestants, they had to secure a special dispensation to marry in the Cathedral.-Gordon K. Lister, Secretary, 294-B Heritage Village, Southbury, CT 06488

31

We sadly report the following deaths. Charles Terwilliger of Laramie, Wyo., passed away on February 17, 1988. He was an avid clock collector and was a member of the National Collectors and a trustee of its museum in Columbia, Pa. He was also president and founder of the Horolover 400 Day Clock Co. and author of the Horolover 400 Day Clock and Repair Guide. . . . Theodore G. Merrill of Amherst, Mass., passed away in September 1988. . . . Meryl Perkins of Santa Cruz, Calif., died May 23, 1987. Our sincere sympathy to all family members of these classmates.— Edwin S. Worden, Secretary, P.O. Box 1421, Mount Dora, FL 32757. John Swanton, Assistant Secretary, 27 George St., Newton, MA 02158

32

Harry Johnson writes: "Am now a widower, but otherwise in good health and spirits. What more can I ask? Three fine children and eight grand-children." . . . John Strickler, Jr., and wife celebrated their 50th wedding anniversary last March 31. All of the 1938 original wedding party attended. . . . Russell Robinson can't be kept idle or retired. He must keep his mind going. He is starting up a new company that will manufacture trailers for towing bicycles and other wheeled goods. Otherwise he is aging as gracefully as possible.

Mrs. Katherine S. Burrows and her husband, Owen, '31, are now Florida residents, returning to Cape Cod for July and August. They are active in their church, help with Meals-on-Wheels, like to walk the beach, enjoy company, reading, and her flower garden. . . Stewart Phillips, after living for 40 years on Narragansett Bay, hás moved to Providence because of its convenience. Still travels a lot—trips to the West Coast and Bavaria last June. . . . Kenneth W. Smith writes: "Betty and I are enjoying living on the west coast of Florida." They drove to Marietta, Ga., for Christmas. They are busy trying to keep healthy and active and are watching their investments. "Best wishes to all for 1988."

We are saddened to learn that **Thomas B**. **Rhines** died in March 1988 after a long illness. He was associated with the aircraft industry from its infancy. He flew as test engineer on performances and speed trials with Charles Lindbergh, and tests of the S-42 Flying Boat with Igor Sikorsky. He was credited with a number of pa-

tents for aircraft propeller design. As Hamilton Standard Division of United Aircraft became the world's largest manufacturer of aircraft propellers, he rose to become its chief engineer and assistant engineering manager before retirement in 1970. He enjoyed teaching, both in his profession and informally. The ideas of science were a great pleasure to him, which he communicated to others. After retiring he turned many pent-up ideas into working devices for woodworking, electronics, and weather recording. In fact, his designs for rate-of-rainfall gauges and accumulating-rain gauges challenged the professionally available gear.

He was particularly proud of his associations with Tech, keeping a lifelong friendship with his roommate, Carroll Wilson, and Dave Lee, '33. His years at DKE and his experience managing the Crew and Athletic Association were happy memories. He was a member of Tau Beta Pi and later the Society of Automotive Engineers and the American Institute of Aeronautical Sciences.

He was active in community affairs both in Glastonbury, Conn., where he lived 32 years and served three terms on the Board of Education, and in Hancock, N.H., where he and his wife moved after retirement. There he served 15 years on the town planning commission, many of these as chairman. His wife of 52 years, Olive Symonds Rhines, continues to live in Hancock.

We also must report that **John Navas** died in October 1987 after a severe fall in his apartment. He was founder of the company, Fittings-That-Fit, which was recently sold.

We have received sad information of the following deaths: William Hall, Jr., on August 19, 1987; George Goodman, on January 1, 1988; Fredrick C. Roberts, Jr., on April 28, 1987, after a long illness; Winston Braxton, in July 1987; and Zebulon White, Sr., in 1987. When we receive more obituary information, we will pass it on.—Melvin Castleman, Secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

33

First, the sad news—obits. Winthrop Adams died December 29, 1987. No further information. . . . Joseph M. Dailey died May 8, 1987. His son, Mark N. Dailey, lives at 12 Argonne St., Quincy, MA 02169. . . . Pierre S. Du Pont died April 9, 1988. His daughter, Mrs. Jane Du Pont Kidd lives at 3801 Kennett Pike, Wilmington, DE 19807. Donald A. Thompson died August 3, 1987. His widow, Betty, lives at 210 Bolton Pl., Baltimore, MD 21210. . . . Joseph A. Murphy died August 10, 1985. Survivors are unknown.

Warren Henderson's son, also Warren, writes from Venice, Fla., to extend thanks to classmates for remembrances to his dad. He says about his father, "His love for his school remained throughout his life, and he instilled in his children the value of an education. He cared."

Positive notes from those still with us. Warren Daniels is in his 13th year as a travel counselor (second career). He visited Yugoslavia, cruised South China and Java Seas, and is enjoying Elderhostel courses. . . Ellery Clark and his wife, Louise, took a long trip by bus, boat, and trailer to Oregon, Washington, Idaho, including a cruise up the Columbia and Snake Rivers, the Pendleton Round-up, rallies, and caravans.

Lawrence Hubbard reports he's ill but recovering. . . . Bill Baur is active with the M.I.T. Club of Tampa. . . . Emerson Norris was hospitalized due to a fall and a heart attack (no date given). He and Mrs. Norris can be reached by writing to Box 145, Newcastle, NH 03854. . . . Walt Swanton, who lost his wife in 1986, is keeping himself very busy in graphical econometrics. He lives in West Henrietta, N.Y.

This is being written on May 2, but it does not appear in the *Review* until after our reunion. Hope we had a good one!—William B. Klee, Secretary, Box 7725, Hilton Head Island, SC 29938

34

I must apologize for the absence of our class column in the past few issues of the *Review*. It is the result of a severe case of procrastination prior to and then after the Christmas holidays, a low level of energy that comes with four months of fighting pinched nerves in my back, and, on the brighter side, a new marriage early in March, with a week's trip to Antigua. But I'm finally in harness again.

One of our recent losses was Henry "Hank" Mertens. I had not seen him a lot in recent years, but we had a lot of classes together in school. The memorable thing to me about Hank is that he was the only Course VI man I can remember who actually got a job in 1934 in the power industry, which was mostly what we studied in "straight VI" in those days. Having started with the Central Maine Power Co. in the Augusta area, he was sent to Lewiston, where he put in a 20-year stint in operations, the last ten as a divisional manager. In 1962, he was transferred back to CMP's general offices in Augusta to begin a series of executive responsibilities. These culminated in 1971 with his election as executive vice-president and director. He retired in 1974. In both areas where Hank lived, he was active in civic and charitable work, and he was a long-time member of Masons. He is survived by his widow Madeline, two daughters, a sister, two brothers, and four grandchildren.

Another familiar name among the losses, from my days on Long Island, is that of Earl K. Murphy, who died last September 21. I don't have much about his career, but his widow, Sheridan, notes that he is also survived by his son K.C., '76, three daughters, and six grandchildren.

Elizabeth Rusling writes that her husband, Lee J. Rusling, died last February 22. He left M.I.T. in his sophomore year and later founded the investment firm of Howe & Rusling, Inc., which was recently written up in Money Magazine as one of the country's 74 top investment firms and one of the top 10 in New York state. In addition to his wife, he is survived by three children: Lee J. Rusling, Jr. of Seattle, Wash.; Thomas Griswold Rusling, currently head of Howe & Rusling, Inc. Rochester, N.Y.; and Lindsley Rusling Shearer (Mrs. Frederic) of Woodford Green, Essex, England.

On December 27, 1987, Thomas Apjohn, Sr., died in Westport, Conn. He had worked for Mobil Oil Corp. for 38 years during which time he held many positions. He was senior chemical buyer at the time of his retirement some years ago. In World War II, he had served as coordinator for the Petroleum Administration for Defense, and later in the Korean Conflict, he served in a similar position for the Petroleum Defense Administration. Mr. Apjohn is survived by his wife Helen, a son, a daughter, and five grandchildren.

Aldo Minotti of Winchester, Mass., died last February 6. A graduate in architecture, he had operated his own firm in Waltham for 35 years, until his retirement in 1980. He leaves his wife Alba, two sons, a brother, two sisters, and five grandchildren.

To all of the families involved with these losses, I extend sympathy and condolences from the class.

John McHugh, Jr., writes, "It would be nice to know where the placards ended up that Jack Summers had on the back wall of the old squash courts. If they were placed back up on the Du Pont building, the Alumni Fund might get big contributions." . . . A brief note from Bill Coleman: "Still living in St. Petersburg, Fla." . . Ed Asch writes, "Last fall we took a cruise through southeast Asia—Thailand, Malaysia, Indonesia, including Bali and Singapore. In the spring, we drove to and through California, with a stop at the fabulous gem show at Quartzite, Ariz. This lazy little crossroads town (population 600) comes alive with 25,000 exhibitors, buyers, and lookers. Just returned the end of October from Epcot



After 50 years, returning to march in an M.I.T. Commencement Procession was a moving experience, say members of the Class of 1938. The picture shows the leaders of the delegation—21 in all— waiting to begin the march from Rockwell Cage to Killian Court on May 27. Right to left: Norman B. Leventhal, G. Edwin Hadley, Albert O. Wilson, Jr., Robert V. Campbell, Matthijs G. Boissevain, Norman C. Bedford, and John A. Petroskas.

Center, a fascinating place. Had lunch with Barbie and Bob Roulston."

Larry Stein writes, "We are both well and working to some extent. Geri is still head librarian at North Quincy High School, and I have two consulting jobs that keep me quite busy. Our daughter April and husband adopted a little boy, Rafael, in Lima, Peru, last February. Then, in December, our son Robert and his wife returned after five weeks in Bogota, Columbia, with a little boy, Benjamin. Both kids are great delights to their parents and to their grandparents. Our other two grandchildren are older, Michael, 12, and Amy, 9. Our own youngest, Lauren, got her degree magna cum laude from UMass/Boston."

From Winton Brown: "Remarried September 26, 1987, to Elizabeth Haynes of Centerville, Va. May move to Virginia in the next year or so." . . . Malcolm Stevens writes, "Julie and I spent an exciting and different Christmas with our very good friends, Mary and Jim Eder, in a 400-year-old home near Taunton, England. Since the 1500s, a microwave oven has been added to the kitchen and a TV to the music room. Just like home." . .

From Irving Kusinitz: "Not much excitement for 1987 except a short trip to Grand Cayman Island last spring—lots of snorkeling and a scuba session. Big news is purchasing a new condominium in Salem, Mass., after selling home in Marblehead. Consulting has dropped off, perhaps because I'm too involved with retirement. Also, we went to Hawaii and toured the Canadian Rockies last fall. The next planned trip is to Israel.

Since the past mini-reunions have shown a reasonably hard core of party-goers, Carl Wilson and the reunion committee have planned another one for September 13-16 at the Basin Harbor Club, Vergennes, Vt. Mailings were sent out to those who attended the 50th, 51st, and 53rd reunions. Cash Belden, who did the bird-dogging on this location, has been there and has great things to say about it. If you are interested but did not receive any of the earlier information, drop a line to Carl Wilson, 48 Druid Hill Rd., Newton Highlands, MA 02161, and he'll be glad to send you the information.-Robert M. Franklin, Secretary, P.O. Box 1147, Brewster, MA 02631; George G. Bull, Assistant Secretary, 4601 N. Park Ave., Chevy Chase, MD 20815

35

A brief note came through the Alumni Office from **G. Donald Fenton** giving his phone number in Sun City, Ariz., where he is now living: (602) 584-4933. He moved there from Paxton, Mass.

I wrote to Ham Dow about my coming to San Diego County in the fall, and he talked to Irving Banquer about my plans. Ham wrote me a nice long letter answering all my questions, along with news clips to emphasize his points. According to Ham, Irving suggested, "Tell Allan to first find and marry a rich widow before moving." I am having some second thoughts about moving, but only to take time to see if there is another way to do this. Will keep you advised.

At the March 10 meeting of the Northeastern Section of the American Chemical Society, Walter H. Stockmayer was awarded the Theodore William Richards Medal. His Richards Medal address was "Adventures with Chain Molecules." Congratulations from your former classmates.

I have received notices of the deaths of two more of our class: Carson L. Brooks died last August 26 in Phoenix (reported by his widow), and Walter P. Green died last September 14 in Providence, R.I. (reported by his son John W. Green of Lawrence, Kan.). I am extending our deepest sympathy to the surviving family members.—Allan Q. Mowatt, Secretary, P.O. Box 524, Waltham, MA 02254, (617) 899-0358

36

From Charlotte, N.C., about halfway in our quasitranscontinental odyssey via our VW camper: so far we have visited 16 members of the class of '36 and three Bradford College classmates of Phoebe. I have more to report than could be fitted in several issues. So I will mention all of the names, make a start on the news, and carry over to future issues. Leaving Santa Fe April 3, we saw Edith and Ford Boulware in San Angelo, Tex.; Victoria and Claxton Monro and George Cummings in Austin; Lucille and Charlie Holman in Montgomery north of Houston; and Catherine and Gerry McMahon in Lake Charles, La.

Then on to Florida's east coast: Leo Kramer at Palm Beach Gardens; Florence and "Bunk" Knudsen at Palm Beach; and Eleanor and Roy Thompson at Boynton Beach. At this point, we took time out for a week of sailing at the outer Bahama Islands on a ketch Phoebe used to own. When we returned, it seemed that we might have run off the Florida season calendar, because there were more don't-answers to preliminary telephone calls and no busy signals. But ever onward—the Tamiami Trail to Mary Lou and Gordon Thomas at Marco Island; up the Gulf Coast to Sara and Bob Caldwell at Naples; Harry Easton at Punta Gorda by telephone; and Betty and Ed Nicholson at Sarasota.

At this point we chose an inland course northward, foregoing the shore in order to see an old roommate and my older brother. In Georgia we visited Bernadette and Roman Ortynsky in Peachtree City; talked with Bill Bode and Lou Young in Atlanta, and relaxed at my brother's home in Anderson, S.C. Then over the Smoky Mountains to Charlie Hobson and Bob Hunt at Knoxville, Tenn.; back to Asheville to see Astrid and Stan Johnson; and now, after one month of travel, at Charlotte with Grace and George Crummey. At times we feel a bit like gypsies, but the warmth of greetings from friends dispels it, and we had good training for life on the road and in campgrounds in Germany, Italy, and Austria.

At dinner with Ford and Edith, we raised our glasses to toast the life of Mike Kuryla, who died in late 1986. I had talked with Mike just before our 50th reunion, urging him to join us in rowing on the Charles, but his health would not permit it. He had been vice-president of Cerro De Pasco in Peru, and moved to Miami after retiring in the late 70s following an airplane crash which left him lame and using a cane. He visited Ford in San Angelo in 1982, and they were usually in touch with each other at year-ends.

From Bunk Knudsen I learned that Spencer Mieras died in December 1987. He had been ill for a few years, had open-heart surgery, and went to Cleveland Clinic and Michigan for radiology and other treatments. Bunk and Spencer were roommates in Cambridge and many years later worked together at White Motor Co. Spencer was Bunk's vice-president, overseas operations. . . Also last year, Maj. Gen. William M. Creasy Jr. died in March. He came into the class as a graduate student in Course X-A. Bill was one of some 30 X-Aers who annually have corresponded at year-end with Bill Rousseau, who in turn duplicates and circulates to all. George Cummings lent me his sheaf from 1986, which is labeled Volume No. 50! The general included a picture of his recent bride Sally, and had just returned from New York City to their home in Pine Bluff, Ariz. I wish they had had more years

In Florida I confirmed the long-ago death of John Sheehan May 11, 1977. Jack was with us for two years only, returning home to help run the family department store, Sheehan Dean & Co. in Elmira, N.Y. Later he was general manager. His widow Ida, at 7421 W. Venetian Place, Hollywood, FL 33023, told me that Jack was always active despite emphyzema and, after retiring to Florida, helped at the Sheridan Vocational Center as registrar, counselor, and with just about any problem that came up.

together.

Lastly, Edward Pratt died March 30 this year after a life of service in medicine. Ed got his M.D. at Harvard and taught and researched pediatrics at Yale, Cambridge-England, New York University, University of Texas, and on and on. We knew each other mainly at the boathouse, and I tried to get him back for rowing at the 45th and 50th reunions. But even in his 70s he was too busy, as professor at Children's Hospital Medical Center in Cincinnati, to break away. Ed's widow Esther is at 922 Rookwood Dr., Cincinnati, Ohio 45208.

Let's give cheers for all these lives of service!— Frank Phillips, Secretary, 901 Los Lovatos, Santa Fe, NM 87501; James Patterson, Assistant Secretary, 170 Broadway, Pleasantville, NY 10570 Norm Birch of Lakeland, Fla., reported the death of Lee Current, which was covered in our July class notes. In Norm's letter of April 8 he writes: "The sudden passing of a classmate, with whom we had spent a happy day of retirement only ten weeks earlier, put me into a retrospective frame of mind, and I found added inspiration for my remarks in reviewing that marvelous 25th-reunion booklet of June 9-10, 1962, which I find much more interesting than our 50th! The first 25 were the years of drive and accomplishment for many, and now most of us are coasting. Comfortably enjoying life, as perhaps 'we are entitled; we have earned it,' but much of the time coasting nevertheless.

"I was impressed, probably more now than when I first read it, by Leo Moore's seemingly sentimental tribute entitled The Man from M.I.T.' in that reunion booklet. Probably M.I.T. did indeed, as Leo wrote, bring out the best in each of us in 'the challenge faced, the crisis met, and the job well done'—as I quoted in reference to Farmer Lee at today's memorial service. Probably we have indeed built better than we knew, but for those of us still in reasonably good health (and in charge of our faculties!), there is an unprecedented new challenge in today's reality to which we should, and must, respond.

"It is best stated in the forward of a new paperback just out, State of the World 1988, which concludes: 'We are left with the sobering realization that our generation is the first whose decisions will determine whether the earth will remain habitable. Unless ripples of public awareness build to a groundswell of support for far-reaching change, we may not be able to reverse the trends that are undermining our children's future.' The book has a wealth of data, intelligently organized and presented, and suggests what needs to be done. It reads easily, and I would urge everyone reading this to buy not one copy (at \$9.95) but two to four copies (at \$6.95 each), and give one to a friend. Write: Worldwatch Institute, 1776 Massachusetts Ave., N.W., Washington, D.C. 20036. The hole in the ozone layer, the greenhouse effect, the destruction of world forests by acid rain, the continued pollution of unrenewable ground waters, the increasing desertification of what arable land remains, the world population approaching 5 billion-we can no longer hide from these issues, nor should we. The current situation is simply a matter of the physical wellbeing of the planet Earth. And as we are all the 'Man from M.I.T.,' we need to take part in that groundswell of public support from thinking people all over the world now to make the international decisions and cooperation simply to keep the earth habitable."

Joseph S. Danning of Los Angles retired November 1979 as vice-president—Administration at McDonnell Douglas Co. His wife Vivian's main interest is the L.A. County Museum of Art. He has received several United Way public service awards. He is a member of the board of directors of the Long Beach Community Hospital, the Southern California Rapid Transit District, the United Way of Greater Los Angeles, the United Way Region I L.A., and a member of the Visiting Committee for Aeronautics and Astronautics at M.I.T. His hobbies are travel, photography, TV, gardening and golf. . . . J. Edward Lynn of Old Greenwich, Conn., writes: "June 24, 1987, I had one knee replaced by a prosthesis. On July 1 the other knee was replaced. Both at Mayo Clinic, Rochester, Minn. Now walking normal. No crutches or cane. Osteoarthritis was the culprit, making me walk as if I were a cowboy."

Phil Peters of Wellesley Hills, Mass., writes, "Ruth and I were in Florida March 2-30. While there we had dinner with Rose and Bob Thorson, Alice and William John, Janet and George DeArment (all at the same time). Ruth is much better, cough is gone and she's hitting a long golf ball with new graphite clubs!" Phil is chairman of

the Babson College Corporation and vicechairman emeritus of the World Affairs Council. On March 31, Sherman C. Luk, '87, senior gift coordinator, wrote our class president Phil Peters the following letter: "On behalf of the class of 1987, I would like to express my deepest appreciation to the class of 1937 for its generous Matching Fund to our Senior Gift Solicitation Program. Your contribution made our class gift, the You Are Here' maps, more meaningful to the M.I.T. community. Again, thank you for the generous contribution." . . . Carl G. Sontheimer of Greenwich, Conn., was president and co-founder with Mrs. Sontheimer (Shirley M.) of Cuisinarts, Inc. Previously Carl was founder and president of several electronics companies in Conn. He has recently left his position as president and is now a consultant to Cuisinarts, Inc. Carl was elected to membership in the prestigious Babson College Academy of Distinguished Entrepreneurs in 1982, and was granted more than 50 U.S. patents. His international memberships include Chevalier de l'Ordre National de la Legion d'Honneur, and Confrerie des Chevaliers du Tastevin. He is a member of the Chemist's Club in New York City, the National Housewares Manufacturers Association, the American Institute of Wine and Food. the International Association of Cooking Schools, the Landmark Club in Stamford, and Chicago's Carlton Club, Center Club, and MidAmerican Club.

Last November, Robert Paul Rudy of New York City wrote, "I have just heard from Kay Booton that Jack died quite suddenly on November 9. Jack and I wrote our thesis together. We kept in touch on a fairly regular basis; we even expected them at the reunion. But Jack didn't want his physical condition discussed, and so this came as quite a shock and surprise. We were good friends." John G. Booton, Jr., of Selinsgrove, Pa., married Catherine Kage in 1944. They had two daughters, five grandchildren, and three greatgrandchildren. During his working career he was a consulting industrial engineer at Mohawk Carpet Mills, Beechnut Life Savers, Champ Hats, Philips Industries, and was chief engineer at Masonite Corp. He was a member of the American Association of Industrial Engineers and the American Material Handling Institute. His hobbies were photography and swimming. His wife is a mystery writer under the name Kage Booton, and has published nine books in hardcover plus many stories in Ladies Home Journal, Cosmopolitan, and European magazines.

I also regret to report the deaths of James Carson Agnew and Eleanor Ryan Hughes. James died last February 18 in Brattleboro, Vt. He was chief engineer and director of Winston Bros. Co. in Minneapolis retiring 16 years ago. He was a U.S. Army veteran of World War II, serving with the Army Corps of Engineers. He was also president of the Guilford Historical Society for six years during the restoration of their museum and the Guilford Center Meeting House. He served as a Guilford representative on the Council of Aging. His wife, Elizabeth Wurst, died in 1984. He is survived by a son, James Agnew of Milton, Mass., and two grandchildren. . . . Eleanor, wife of Walter L. Hughes of Bellport, N.Y., died April 18. We are happy we were able to see her at our 50th reunion.-Lester M. Klashman, Secretary, 289 Elm St., Apt. 71, Medford, MA 02155

38

With the 50th reunion just a fond memory, it may be of interest to those of you who contributed to the 1938 Scholarship Fund that we are helping three fine students in pursuing their education at M.I.T.—two seniors and a junior. Incidently, if you have not contributed to the fund, it's never too late.

Last May the class held a telethon to get some more of you to come to the 50th. In the course of the phoning, it was learned that the Reverend Louis Bradford is retired, reads two newspapers a day, loves to go overseas on liners, and, to top it off, like the "frugal gourmet," is a good cook.

. Also learned was that Gerson Hermann passed away several years ago.

Frank Gardner wrote me to tell of the death of Jack Hilcken last January 24. He is survived by his widow, who resides at 5035 Edgemere Blvd., Richmond, VA 23234. Jack was trained at M.I.T. as a biophysicist at a time when there were few. He entered the army, becoming involved in the effects of nuclear radiation. Along the way, he received the degree of Doctor of Biology and retired from the army as a full colonel.

Lastly, through a class mailing, it was learned that **David Irving**, of 1433 Waverly Rd., Gladwyne, PA 19035, died of a massive stroke on March 23. Prior to death, he had been in splendid health.—A. L. Bruneau, Jr., Secretary, 663 Riverview Dr., Chatham, MA 02633

39

Bill Wingard, chairman of our 50th reunion, outlines the schedule. Reunion will start after lunch Sunday, June 4, 1989, at Chatham Bars Inn, Chatham, Mass. Activities continue there through lunch Wednesday, June 7, when buses will take us to Cambridge. In Cambridge individuals may choose housing at the dorms or elsewhere. Thursday, June 8, events will include a late-afternoon buffet lunch then buses to Symphony Hall for the traditional Tech Night at the Pops. Friday June 9, is Technology Day. On Saturday, June 10, activity will continue through lunch to the official end of our 50th reunion and the unofficial start of getting ready for our 55th!

Bill Wingard, Sid Silber, and others have worked hard to organize all this. They are on schedule. Let's help by being prompt in our responses.

Jim Barton, chairman of our 50th reunion gift committee, reports the following good news from classmates. . . Dick Loesch, retired now from a career in flight testing with Boeing, has a special memory in his bundle of reminiscences. Some years ago Dick was command pilot during the test flight of Boeing's first B-47 swept-wing bomber. During April 1988, Dick's son Jamie was copilot on the maiden flight (6,000-mile) of Boeing's 747-400. . . . Barry Graham is touring four cities in the USSR with the "People-to-People" or "Citizens' Diplomacy" project. Barry's daughter is tour leader. Jean and Barry plan to attend our 50th and visit Ginny and Fred Grant. . . . Austie

Lucile and Bill Brewster write: "We made a month's trip to Thailand, Viet Nam, Kampuchea, and Borneo. Mainly focused on Viet Nam and Borneo. Very interesting, colorful, and sad. Saw the Holden Withingtons and the John Alexanders on our way west. On another trip we saw Trixie and Gordon Pope in Naples, Fla., where Trixie demonstrated great skills as a fisherwoman." . . . Harold Muckley resigned chairman and chief executive officer positions at Partners Oil Co. . . . Hazel and Walt May expect to attend our 50th.

and Hans Bebie and Viola and Hew Phillips are

planning to attend our 50th.

Myron Norman sold his wine import business and continues as a wine broker. . . . Aaron White's hobby is making special tapes of his favorite bands and soloists. Aaron and Ernie Kaswell are scheduled to attend a meeting at M.I.T. on conducting class reunions, so we expect good things will come from that starting Sunday, June 4, 1989.—Hal Seykota, Secretary, 1701 Weatherswood Dr. NW, Gig Harbor, WA 98335

40

Russell L. Haden Jr., writes from Issue, Md.: "Still active at age 69 in consulting; am my own builder of a house; starting an adhesive company." . . From Barret L. Taft of Maitland, Fla. a note: "I resigned from United Technologies Corp.



J. Herbert Holloman, '40

(Pratt & Whitney Aircraft Division) in 1965 after serving 25 years. I was locked into their pension plan and started collecting retirement pay in November 1983."

John C. Klock says, "Retired from Ethyl Corp. in 1980. Enjoying life playing golf, fishing, traveling abroad, and visiting our grandchildren." John lives in Baton Rouge, La. . . Also on the traveling circuit is Richard G. Falls of N. Brookfield, Mass.: "My wife and I spent four months last summer (their winter) visiting her sister in Australia and traveling around the country, including Alice Springs and Ayer's Rock. We are expecting our tenth grandchild in May."

Sadly, we must report two deaths at this time. **Kendall C. Valentine** died on April 2, 1988, in South Glastonbury, Conn., after a lengthy illness. He is survived by his wife, three sons, four grandchildren, and one great-grandchild.

C. Gordon Livingston of Rancho Palos Verdes, Calif., passed away on February 14, 1988. He is survived by his wife, two daughters, a grandson, and two brothers. He served as a naval pilot during World War II, was a navy test pilot, and later became a civilian experimental test pilot and fellow member of the Society of Experimental Test Pilots and Soaring Society of America.

The Board of Governors of Acta Metallurgica, Inc., has established an annual award in Memory of J. Herbert Hollomon, principal instigator of the journal Acta Metallurgica and who conceived the journal Materials and Society. Acta Metallurgica, Inc., represents 27 professional societies worldwide in publishing three international journals and in other activities supporting the materials profession. The new award will recognize contributions to understanding the interactions between materials and societal concerns. It will consist of a Steuben glass sculpture on a suitably inscribed base, a certificate, and a cash honorarium, initially \$2,000.

Send information about yourself or classmates to Class Secretary Richard E. Gladstone, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

41

Walter E. Carran, Jr. died October 30, 1987. . . . Lewis T. Jester, Jr. retired since 1982, won a gold medal for 60 and over skiing at Lake Tahoe in January 1988. Lew and his wife explored Antarctica with Lindblom Travel in February this year. They live in Marion, Ohio. His handwriting is still illegible. . . Dorothy and William R. Burke, Deerfield Beach, Fla., took a great trip, sponsored by the M.I.T. Quarter Century Club, through the Canadian Rockies. Stanley Marple, Jr. and his wife were on the same trip.

A celebration to honor Dean Ann F. Friedlaender, Ph.D. '64, Class of 1941 Professor, was held April 22, 1988. Ann is a graduate of Radcliffe and Harvard and studied economics at M.I.T. She spent one and one-half years in Finland as a Fulbright Scholar. Her husband is a practicing architect, and they have two sons and live in Newton, Mass. Carl M. Mueller, D. Reid Weedon, Jr., James W. Mar, Leona N. Zarsky and your secretary attended this happy occasion. Carl Mueller presented Ann with an M.I.T. T-shirt with Class of 1941 Professor emblazoned on the

back.

David S. Saxon, who also attended this party, is chairman of the M.I.T. Corporation. He has been named to head a 19-member panel studying the future of the University of Massachusetts. Before coming to M.I.T. in 1983, David was president of the University of California system for eight years.

For something entirely different: Arthur Gigrande of Boxford, Mass., has been inventing things all his life that people, and now animals, use. His latest inspiration is an improved kennel door. The new door has a light spring and is made of metal. The door moves on a center pivot so that the dog can enter on one side and exit through the other. It will be manfactured by Art's own company, B & G Manufacturing in Newburyport.—Joseph E. Dietzgen, Secretary, P.O. Box 790, Cotuit, MA 02635

42

Ben Skinner writes, from Dunedin, that he and Angela are enjoying sailing up and down the Florida coast in their 34-foot sloop. . . . Sandy Peek has a going business in Bakersfield, Calif., selling data to weather stations and to fruit growers in the San Joaquin Valley. . . . Walt Eberhard is playing golf, tennis, and is square dancing several times a week in Sun City, Fla.

In the "Never-Gonna-Retire" Department, Jean and I plan to winter in 1988-89 again at Top of the World in Clearwater. We have rented there starting November. This year I packed my computer, printer, copying machine, and a few files and ran Ken Rosett/Associates from there. There are no problems with commuting out of Tampa airport; it's better than LaGuardia. I was on the road seeing clients about a quarter of the time. Working mornings and playing golf just about every afternoon is not heavy lifting. We attended some of the M.I.T. Club of Tampa Bay's excellent programs. The club meets variously at Tampa, St. Petersburg and Sarasota. We also visited with Joan and Dick Knight, '47, who winter in Clearwater. Dick was the genial and very capable secretary of the Alumni Association for many

Two obits this month: Albert Knight, who has a bachelor's degree from Union College and transferred to Tech sophomore year, died in Canandaigua, N.Y. . . . Gideon Hofmann, of Pasadena, Calif, also died recently. Gideon was born in Mainz, Germany, and transferred from Northeastern University. Our sincere sympathy to Alice Knight, Laura Hofmann, and the families.—Ken Rosett, Secretary, 191 Albemarle Rd., White Plains, NY 10605

43

There are several obituaries to report this month. William H. Peiler died September 3, 1987, in Kingwood, Tex. Bill was a native of Hartford, Conn., a navy veteran of World War II, and a 1983 retiree from Gulf Oil Co. He is survived by his wife, Cecilia, six children, and other family members. . . . From Kemp Maples comes word that Jim Broderick (Course VI-A) passed away January 27, 1988, in Ellicott City, Md. Jim served in the ETO as a Signal Corps officer during World War II, then was a grad student at Tech and Newark College of Engineering. His career in electronics took him to ITT, Westinghouse, RCA, and NASA, from which he retired in 1981. Jim is survived by his wife Anne and three children. Dick Feingold kindly forwarded news about the passing of Charles M. Clapp (Course I) February 4, 1988, in Massillon, Ohio. Charles is survived by a daughter, Charlene. We extend our sympathies to the families and friends of all these departed classmates.

Bill Laird writes that he has come out of retirement to teach mathematics full time at La Roche College, Pittsburgh, Pa. Son Walter, a navy lieu-

tenant and third generation of Lairds at M.I.T., hosted dad at the 45th reunion in Newport.

The ever-youthful Malcolm Walker reports that he retired in April 1983 from General Dynamics Shipbuilding, Quincy Yard. To while away the idle hours, he serves as a volunteer for the Braintree Historical Society, chairman of the Braintree Historical Commission, co-chairman of Braintree's 350th Aniversary in 1990, and a director of the Braintree Savings Bank. He doesn't mention golfing with our lotus-eaters in Florida.

A note from Zion tells that **Dick Zeamer** is a project manager at the Hercules Aerospace Division, Magna, Utah, where he is responsible for a government technology contract and research investigations.

I have two lengthy news items to carry over, plus the reunion story, so there should be material for the class notes well into the winter.—**Bob Rorschach**, Secretary, 2544 S. Norfolk, Tulsa, OK 74114

44

It was a great pleasure to be present at the IEEE Medals Presentation on May 9 in Boston to see J. Ross Macdonald receive the Edison Medal and join the illustrious company of previous recipients such as Elihu Thomson, George Westinghouse, Nikola Tesla, D. C. Jackson, Vannevar Bush, Philip Sporn, Vladimir Zworykin, Charles Kettering, Charles Avila, Daniel Noble, and other extraordinary engineers. The citation for Ross is "For seminal contributions to solid-state science and technology, and outstanding leadership as a research director." He is a fellow of the IEEE and a member of both the National Academy of Engineering and the National Academy of Sciences. In 1986 he received the Pake Prize of the American Physical Society for combining research accomplishments with leadership in the management of research in industry. He has received several other awards from the IEEE and the IRE. Our heartiest congratulations go to Ross, who is currently professor of physics at the University of North Carolina at Chapel Hill.

William A. Jack tells us that since retirement in 1983, he and Evelyn have traveled each year, domestically and abroad. He is doing his civic bit as a member of the City Council, County Economic Development Committee, and the Hospital District Board. He lives in Cannon Beach, Ore.

Edward Radford reports that they are settling into their "new" 1898 house outside of London. Despite being officially retired, he remains busy with continuing research and consulting. Although he enjoys England, he often gets back to the U.S. . . Herbert Knape writes that he is still running Knape Industries but had to take time off for a hip replacement. We hope by the time these notes are published that his recuperation in Florida is complete. . . . We described the third career of Al Van Rennes in the May/June 1987 notes. He says that he is looking forward to his fourth career when his contract with the Republic of Indonesia ends in 1989. . . . From Melissa Teixeira comes word that for the sixth time in eight years there were more attendees from the class of '44 than from any other class at the annual M.I.T. fiesta in Mexico City. Dagmar and Arturo Morales joined Albert Hildebrandt, Carmen and Bill Van Ravenswaay, Melissa Teixeira, and Marge and Dick Whiffen for the fiesta's Thursday-night banquet. This 40th fiesta was the best one yet, and the Mexican Committee will find it difficult to match in the future.

We have received word from the Alumni Office that Conrad Chapman is now in a nursing home, but we have no further details. . . . It is our sad duty to report that Bruce Lamberton passed away in Strongsville, Ohio, on March 9. Bruce received both his bachelor's and master's degrees in civil engineering, and was president of Construction Techniques in Cleveland. Our condolences go to his widow, Jacquelyn.

The reunion committee met on May 5 at the

home of Diane and Andrew Corry. Present were Marguerite and Ed Ahlberg, Anita and Les Brindis, Jane and Louis Demarkles, Janice Kispert, Ruth and Norm Sebell, and Stan Warshaw. Planning continues for the 45th reunion in Bermuda. Stay alert for further mailings.—Co-secretaries: Andrew Corry, 16 Brimstone Lane, Sudbury, MA 01776; Lou Demarkles, 53 Maugus Hill Rd., Wellesley, MA 02181

46

In the absence of any input, I thought I'd "flesh out" some of the names I've mentioned in years past, mostly as "LKAs" (Last Known Address). Most of them are guys I never knew but who wrote us some nice resumes of their lives in the bio book.

One of them I did know was Ed Richardson (yes, of the Delaware Richardson & Robbins famed food processors). Ed was a Course V-12/XVI buddy who joined me in our short stint at the Philly Naval Yard until our separation in July 1946. He did stick with the Reserve for 21 years, when he retired as a lieutenant commander. Married shortly after graduation, he had two daughters before the marriage broke up and later (1970) was remarried—to Madelyn. He's worked as plant engineer through engineering manager in various food processing companies all these years and is "in reasonably good shape for retirement, if and when." Ed is now living in Winchester, Mass.

I don't think I've mentioned Norm Friedman before, which is too bad for he has an interesting tale to tell. He came to us via a U.S. Navy mistake and spent three semesters with us before being shipped to Harvard as a midshipman and ultimately to an Atlantic Fleet Destroyer as a sonar officer. Upon separation in 1946, he returned to Harvard where he got his Ph.D. in English literature in 1952. He's taught at the University of Connecticut and Queens College and written/published several books. Some time ago, Norm became interested in Gestalt therapy and trained at Adelphi, graduating in 1978 and development a part-time practice, similar to his wife's as a psychiatric clinician. He and Zelda, of 43 years, have a son, daughter, and one grand-child. They live in Flushing, N.Y. Retirement will be just an extention of Norm's life, full of learning, without the hassle.

Al Kent is another course XVI/V-12er whose face I barely remember. He's one of our lucky people who went into the family oil business and was able to retire when he was 52. He spends his time doing useful things in useful causes like environmental issues, hiking, canoeing, and traveling with wife Dorothy, whom he married in 1950 and by whom had five children, two of whom graduated from Tech. They now live in West Orange, N.J., practically across the road from where he was brought up (East Orange).

Roy Klein has made the Grand Tour, so to speak. After his S.B. in meteorology, he joined the Flour Corp., which sent him to European countries and South Africa, not to mention Indiana, Texas, and finally (perhaps) Los Angeles, becoming senior vice-president. His greatest experience was building two huge plants (2 and 3), occupying six square miles and 24,000 employees. They "transport fuel from coal," but I could be reading incorrectly. He retired three years ago to spend time with wife Mary, of 45 years, who plays golf with him. They're living to Newport Beach, Calif., a very nice neighborhood!

George Phillips got his Course XIII letters with us and proceeded on in marine engineering, pausing only to pick up his M.S. in nuclear engineering, which helped him in managing the conversion to our nuclear-powered submarine force. In 1964 George joined Lockheed as director of ocean engineering, involved in design and construction of several classes of deep submersibles including the Glomar Explorer, built in coordination with Hughes Corp. and Global Marine, of

which he later became vice-president, "a job I still cherish." They've mined for oil, gas, precious metals, "and whatever" all over the planet and built the Glomar Challenger for NSF, who used it in their study of the plate tectonics theory. He's also taught ocean engineering at UCLA and Stanford. For some reason, his current address (perhaps) is Katy, Tex., and he plans to continue working "until Georgia, 3, finishes M.I.T." (?) Whatever's right, George!—Jim Ray, Secretary, 2520 S. Ivanhoe Pl., Denver, Co 80222

48

Two cocktail parties were held in April in the continuing series of gatherings to build support for our 40th Reunion next October. Judy and Graham Sterling hosted a gracious gathering with songs by M.I.T.'s own Logarhythms. Sonny Monosson says a super time was had by every one who attended. Sally and Tom Lacy had another group of classmates visit their farm in New Hampshire. Sally put on a demonstration with two of their dogs herding sheep. The dogs moved a group of nine sheep from point to point. Then the dogs divided the sheep into two groups and moved them apart. Although the dogs are smaller than the sheep, the dogs controlled the sheep by barking. The dogs moved the two groups to different locations before bringing all the sheep together for the finale.

Harold Ottobrini presented a gourmet meal to the reunion committee and had them rate every item. Harold is chairman of the Saturday night dinner-dance, and he wanted to check out the caterer and the menu selections. One hundred classmates have indicated they are definitely coming to the reunion, and an additional 136 class-

mates have said they may come.

A mailing was sent in June with registration forms requesting a deposit for the fee. The reunion committee selected a gift for the ladies attending our reunion, and George Clifford was asked to implement purchase. Graham Sterling is continuing to check for an item to present to the men who attend.

Malcolm Read reviewed the options for a reunion yearbook. It was agreed that the biographical material would be as general or as specific as

each classmate wants to write.

Bob Wofsey is working with Ward Howell International and is planning business trips to Arizo-na and Australia. Next will be trips to locations starting with the letter "B." Bob and his wife, Marcia, are celebrating their third granddaughter. They look forward to a grandson-somehow they have determined that he is on the way. . Jarmolow has been appointed corporate vicepresident of technology planning for Martin Marietta Corp. in Bethesda, Md. Ken had been president of a subsidiary company. . . . Bill Weisz is now vice-chairman and officer of the board of Motorola. He had been chief executive officer of Motorola. . . . Ed Mack is senior R&D Chemist at Craig Adhesives in Newark, N.J. His wife, Elizabeth, is in better health but has remained at their Wisconsin home. Their son is a junior at the University of Wisconsin

George Van Duzer Hawkins died of a massive cerebral hemorrhage with no forewarning. George joined IBM in 1949 after receiving his master's degree in electrical engineering. He had planned to retire sometime in the next few months. George and his wife, Marjory, attended the same church in Chappaqua that Ann and Ken Brock attended. They saw one another often at church affairs. George and Ken served on the board of trustees of the church. George served as chairman of M.I.T.'s Alumni Fund solicitations in Chappaqua for a period. Ken wrote and described George as quiet, thoroughly dependable, and committed. On behalf of our class, I extend our sympathy to Marjory, their children, and grandchildren. . . Edward F. Koetsch died at the V.A. Hospital in Northhampton, Mass. Ed owned E.R. Koetsch and Associates in East Long-

Goodbye Dog-eared Dog Doors



hen Arthur Gingrande's neighbor told him that she had problems with her kenneled English bulldogs ripping apart their kennel doors, Gingrande, '41, told her it wouldn't be too hard to design another door. "So do it," she said.

The new dog door, called the "Feathertouch" by two major catalogs carrying it, is a vast improvement over the standard door that kennel owners have been tolerating for years, Gingrande says. Stiff springs that prevent the old door from blowing in the wind also make the door too difficult for small dogs to open, and the springs are noisy and eventually rust away.

Gingrande's design has a lighter spring and operates basically as a damper. "It's dynamically balanced," he explains. Weatherstripping protects the spring from water damage. Also, dogs don't chew on the door like they do the old design: Gingrande's door is metal.

This summer he is involved in the "nitty-gritty of the production," worrying about the boxing and labeling of several hundred doors. Once the business is started, though, he plans to turn it over to his

neighbor and collect royalties.

Gingrande, now retired and living in Boxford, Mass., with his wife, Louise, has other patents to his credit — three electronic devices used in picture tubes that he developed while working for Hitron in Newburyport, Mass., as well as inventions for Western Electric in North Andover, Mass. He also invented an optical illusion machine now owned by the Boston Museum of Science.—*Michael Erard* □

MICHAEL ERARD is a junior at Williams College and a summer intern for Technology Review. meadow and had lived in the area for his entire life. He had been a chemical engineer at the Springfield Armory. He was a World War II navy veteran. He was a Longmeadow auxiliary policeman and had been active in several professional societies. On behalf of our class, I extend our sympathy to his wife, Lorraine, their children, and grandchildren. . . . George Cooper died of a massive heart attack last year. George was 73 years old and had been doing well. His death was totally unexpected. Prior to his death, George was vice-president of Bomar Resources, Inc. in New York City. On behalf of our class, I extend our sympathy to his wife, Nancy, and their family.

Russell Lawton writes from Sonoma, Calif., that after attaining the enviable position of living in Sonoma, his wife, Mary, of 40 years left him to go where the good people must go. The business they made together goes on very successfully. Retirement seems less desirable while business remains challenging. . . . Lt. Col. F. D. Losco earned his M.S. in 1968 from Penn State after retiring from active duty as a regular officer for 22 years in the U.S. Army Ordnance Corps. He taught on the math faculty of Atlantic Community College in Mays Landing, N.J. In 1985 he began enjoying full retirement, playing golf, tending the lawn and garden, and traveling. In June, when his wife, Mary, retires from teaching they plan to increase their traveling with emphasis on visits to the grandchildren currently residing in New York, Virginia, and North Carolina. Dwight Norris is retiring from Pfizer after 38 years with them in Groton, Conn. He began as a chemical engineer in 1949 and was made assistant plant manager in 1971. Since 1973, he has served as plant manager of manufacturing operations for the Groton facility. Dwight grew up in nearby New London and has been active in community affairs in the region.

Ken Brock is an appointed member of the Planning Board of North Truro. This fall he will be a candidate for election to this position. In a recent statement, Ken was quoted as saying that resources, marginal building sites, and affordable property will be three issues dominating town decisions in the next decade. He described the complex issues about water, the increased submission of plans for "marginal" building sites on odd-shaped lots, often with inadequate access, and the difficulty young people have in finding a way to stay in Truro. Ken had served his community when he lived in Medfield, where he was town finance committee chairman for three years, chaired a town committee to install a sewage system, and was a member of the Master Plan Committee.

Larry Manoni retired recently. He has been teaching part-time since then. . . . Bob Sandman has been circulating a list of classmates for whom M.I.T. does not have a current address. Other classmates have provided about ten addresses so far. If you know the address of any of the following classmates, please send the address to me: Richard Barbera, Phillip Bridges, William Folsom, William Hadigian, John Hartigan, Stanley Jacobs, George Karambelas, Frank Kilgore, Robert Klausmeier, Charles Kurz, William Machie, Donald MacNair, Charles Mastroeni, Robert McClintock, Walter Minderman, George Sargent, George Stewart, Arthur Waxman, Mary Reid Gregory (Mrs. Montgomery), Geraldine Mar (Mrs. Haughey), and Gertrude Burbank.-Marty Billett, Secretary, 16 Greenwood Ave., Barrington, RI 02806

49

After 25 years with Hewlett-Packard Co. in Palo Alto, Calif., Austin Marx has taken early retirement from his job as a corporate planner and economist. Austin must have foreseen his HP career with unusual clarity because, while at Tech, he earned exactly the degrees he would need at the firm, an S.B. in electrical engineering

and an S.M. in management. In retirement, Austin lives in Santa Clara, Calif., and works as a volunteer in several nonprofit organizations devoted to such matters as winding down the nuclear arms race, breaking down sterotypes of the Soviets, maximizing human potential, conflict resolution, and youth hostels. Judging by our yearbook, Austin went through Tech in high gear and now, in retirement, appears not to have downshifted a bit.

When you haven't talked with a man in 39 years, it is more than a pleasure to hear his voice again even if it is only on the phone. Manuel Gassman is president and a director of Brite-Line Corp. in West Roxbury, Mass., a firm which he tells me is about to market an exciting new product designed to help drivers see the traffic separator lines on highways, particularly on stormy nights. Charlie Wycoff, '41, invented the product and "Doc" Edgerton, '27, is a backer of the company.

Another 39-year-first-time-on-the-phone man with whom I talked was Joe Vitka. I remember Joe and his wife Mary as though it were yesterday. Both of us worked on the student staff at Walker Memorial. We reminisced about Bill Bridges, who ran the place, and William Hamilton Carlisle, who directed the student staff. Both were "characters" who brought pleasure to our lives. Joe and Mary have a son, three daughters, and two grandchildren. Joe is busy as a consultant

A man who doesn't meet the 39-year test but with whom I had not spoken in a long time is Dick Lang, who lives in Lincoln, Mass. He is retired but back at Raytheon in Wayland, Mass., as a part-time consultant. Dick was another student staffer, but did not have the high regard for proper deportment displayed at all times by Joe Vitka. One day, Mr. Carlisle was dining alone at one end of a long table. Dick, in an effort to demonstrate an obscure law of physics, grasped the tablecloth at the other end of the table and gave it a tremendous yank. I know what you're thinking but the silverware, china, and food did not land on the floor. All remained neatly arranged as before. Mr. Carlisle, a man of impeccable decorum, was startled and distraught that a man for whom he had previously maintained a high regard should take away his tablecloth. For his part, Lang is ashamed and contrite for what he did and claims temporary insanity at the time. Aside from our time on the student staff, Lang and I worked together closely for 15 years at the same Raytheon plant that he has now returned

My reason for calling classmates these days is to remind them about our 40th reunion next year. Where did the time go? We, on the reunion committee, have been meeting for over a year now to organize the affair. One site we are considering is the Black Point Inn in Kennebunk, Maine. By the time you read this, the reunion will be only ten months away. Stay tuned.

Mason Campbell in Topsfield, Mass., has been retired from General Electric for two years now but, like most retired Tech men, time hangs lightly on his hands. In winter he teaches skiing and in summer he plays golf. Mason spent 36 years with GE in the aircraft engine group and, at the time of his retirement, was manager of systems for the F404 engine.—Fletcher Eaton, Secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

50

Harvey Nickerson now resides in Whispering Pines, N.C., after 38 years of employment with the Resistoflex Corp., a division of Crane Co. Prior to his retirement, he was the research manager for the company. . . . Sam Raymond is still the president and CEO of the company he founded, Benthos, Inc., in North Falmouth, Mass. His company built acoustic navigation and the cameras that photographed the *Titanic* last year. The cameras were originally designed by Harold

"Doc" Edgerton '27, Institute professor emeritus, at M.I.T. . . . For the past six years, Saleem Rizk has been an independent businessman in Lynnfield, Mass. He is the owner of the Crown Security Systems, Inc., and installs fire and burglar alarms.

Karol Stark indicates that although he is still a resident of Barneveld, N.Y., his business activity is increasing in the Carolinas and thus he has a second home in Durham, N.C., close to Research Triangle. It is also a place to escape the snow of the northern latitudes. . . . Samuel Tennant has taken over the position of president and CEO of the Aerospace Corp. in El Segundo, Calif. Aerospace provides architectural/engineering support to the Air Force Space Division. . . . Professor John Schmertmann was the general chairman of the First International Symposium on Penetration Testing held last March in Orlando, Fla. He is the principal of Schmertmann and Crapps, Inc., Geotechnical Consultants, and resides in Gainsville, Fla.

The Blodgett Co. of Burlington, Vt., announced that Fred J. Rayfield has been appointed vice-president of operations. . . R. Stanley Bair has been advanced to the College of Fellows of the American Institute of Architects. Fellowship is a lifetime honor bestowed for notable contributions to the profession of architecture. He has practiced architecture in Houston, Tex., for the past 20 years.

We are sorry to announce the recent passing of three of our classmates: Warren W. Lee, of West Simsbury, Conn; William W. Newitt of Galien, Mich.; and Richard C. Granke of Silver Spring, Md.—John T. McKenna, 9 Hawthorne Pl., 10-H Boston, MA 02114-2326

51

The effort for our 40th reunion initiated by our class president, **Bill Maini**, is proceeding. We hope that you received the letter from **Fred Lehmann**, our class agent, outlining information about the handling of our class gift and pledges.

We are continuing our endeavour to determine some meaningful purpose and direction for our class gift. Members of the committee have met with key Institute officials to solicit their suggestions. The committee seems to be heading towards promoting and financing some mechanisms that would promote, motivate, and improve the effectiveness of the education of undergraduates and to elevate the quality and nature of the undergraduate experience. This might take the form of programs and awards rather than a building or facility. The committee would deeply appreciate any thoughts, suggestions, and feelings you have about this innovative direction.

As president of the Cartoon Capers Shrine Unit of the Marocco Temple in Jacksonville, Fla., George Groves is still playing Ye Old Calliope in Shrine Parades. As George puts it, "Old calliope players never die, they just go off on a toot... bad!!!"

Living in Littleton, Colo., James W. Hart is president of Hartech, Inc., and designing microwave and two-way radio systems. His three children—Ruth, David, and Rachel—have completed college. Ruth has her own PR business; David has just applied to M.I.T. for his Ph.D.; and Rachel is a reporter for *The TAB* covering Brookline and Newton. Jim's wife is consulting to volunteer managers.

Having retired in February from GE Appliances to concentrate on golf, fishing, and expected first grandchild, Walter E. Johnson plans to spend time in Naples, Fla., and the Cape. . . . Following retirement two years ago, Eugene E. Koch is now operating Global Tech USA, a travel company specializing in custom itineraries for inbound special interest groups, meetings, and conventions. Eugene celebrated his 35th wedding anniversary last May. . . . After a year of retirement, Edwin J. Martin decided that it was not his cup of tea and is back doing antenna de-

signs for a manufacturer of military aircraft in St. Louis, Mo.

While still traffic manager at Nashua Corp. headquarters, D.C. Whittinghill is busy decentralizing the export operations among 67 manufacturing divisions. . . . After years of roaming, Karel Den Tex writes that he has settled in a delightful home near his birthplace in Mystic, Conn. He is doing volunteer work along with a group of other retirees at the Mystic Seaport and is keeping the shipyard humming. He and his wife Ann travel frequently and are becoming proficient sailors.—Martin N. Greenfield, Secretary, 25 Darrell Dr., Randolph, MA 02368

52

Forbes E. Forbes writes that he is currently working as a senior technical specialist for BWIP International in Los Angeles. Two children, a son, and a daughter are in college in California.

Donald Union has developed and is now marketing a computer system for the eyeglass trade, both retail and manufacturing. He says this is his 34th year programming digital computers. He comments that he understands that the first computer he used, at M.I.T. in 1951, is now in a museum. If he is referring to Whirlwind II, I believe he is right. I remember over 20 years ago when Sandy Isaacs showed it to me at the firm he was working for, where they were making a quixotic attempt to put it back in service after M.I.T. had scrapped it. I guessed that the floor space it occupied was worth far more than the machine, but it was an impressive sight nevertheless. It's too bad we can't donate our now-useless skills developed to use now-obsolete computers to some museum, too .- Richard F. Lacey, Secretary, 2340 Cowper St., Palo Alto, CA 94301

53

While you are reading this well after our 35th reunion, deadlines are such that I am writing these notes three weeks before we all get together. For those of you who attended either at M.I.T. or

Nantucket or both, I hope you had a great time. Over the past five years, I've attempted to write about as many of our classmates as possible, but sometimes there has been a dearth of material. Not so now that my five-year term is ending. Thanks to Dick Lindstrom, there is enough material to keep this column going for a year, and as a result, some of the news in these notes may be many months old. Anyway, what follows is a random sample of information received from or about our classmates.

According to a note received through the Alumni Office, one of our friends in Course VI retired from General Motors Corp. in 1980. But for three years prior to that he planned, constructed, and staffed an assembly plant in India to produce off-highway earth-moving vehicles for Hindustan Motors. After retirement, he went back to college for a bachelor's degree in applied science, and has been working part time tutoring high school students in math. Now if the person this describes writes to me, I'll let everyone know who you are. The Alumni Office forgot to send your name.

A note from Dick Linde indicates that he is currently working for Western Union World Communications as regional vice-president for Europe, Africa, and the Mideast. His activities involve joint ventures with regional entities to provide telex, packet-switched data, electronic mail, and information database services. He and Ruth now have a year-old granddaughter, the child of his son and daughter-in-law. His other son is a junior at Columbia University in mechanical engineering. . . . Vincent Bronson is still "attempting to master the art of orchestrating the teaching-learning process" at Newton South High School. He has two daughters, one working at the Pentagon and the other a manufacturing en-



Now here is a man with a vision of the future! Sherman Uchill,'55, is the founder of a computer retail firm called Sherman Howe Computer Center, and the Apple of his eye is the Mac. According to a profile on him in MacWeek last fall, the Macintosh and its Hypercard software are "the closest anyone has come to Uchill's version of the creative business use of the computer."

Uchill has long envisioned an expanded role for the computer as a management tool; the major obstacle to such deployment, he says, "is not technical, it's cultural." Business schools create managers who may have a microcomputer on their big, clean desk, but they don't really know how to use it effectively to manage. Uchill is working to shake the impression that "a good businessman delegates responsibility and authority . . . that's the culture that [business schools] try to inculcate." He sees the computer, and especially the Mac, as integral to optimal hands-on management.

gineer at Moore, Inc., in Dover, N.H.

Harry S. Markarian writes that he left the aerospace industry in 1970 and is semi-retired. He is now in Tostin, Calif., using a computer to help clients do financial planning. Of his three children, one is an electronics engineer, one is a bank manager in real-estate development, and one (a CPA) is part-owner and president of a company that sells and repairs micro and minicomputers. The middle one is a daughter. . .

Roland Johnson is still an Eastern Airlines captain but is thinking of retiring soon. . . . Thomas E. Shaw is now vice-president of engineering at Sanders Associates, Inc., in Nashua, N.H. . . . Sid Hess retired from ICI Americas a couple of years ago, and is now consulting in mergers and acquisitions while a visiting professor of management at Drexel University. He has two married daughters, two granddaughters, and one unmarried (but looking) son.

Robert J. Beale is with Jet Propulsion Laboratory as deputy division manager of the Observational Systems Division. After 28 years with JPL,

he's had the opportunity to work on most of its NASA-related space projects and on some solar energy activities as well.

Congratulations to David L. Klepper upon his receipt of the Silver Medal awarded by the Audio Engineering Society for his many years of outstanding work in sound reinforcement and acoustic enhancement in large and small acoustic spaces.

Dave is working on a number of acoustical consulting projects, and is active in several related professional societies. He has also been active for many years in the Electric Railroaders' Association, including several stints as national president, and serves in a number of capacities at the Shore Line Trolley Museum in East Haven, Conn.

There's a lot more correspondence, but I'll save it for later (or for the next class secretary, whichever comes first). Also, the next class notes will describe our reunion and give some results of the questionnaire that I hope you all received and returned.—Wolf Haberman, Secretary, 41 Crestwood Dr., Framingham, MA 01701

54

This is your "second notice" that our 35th class reunion is scheduled for June 8-11 next year. Start planning now to join us in Cambridge for the "Pops," clambake, visit with the Grays, and all the rest.

As soon as **Bob Warshawer** gives me more details on the program, I'll pass them on.

Only one note from a member of the class reached me this month. John Graham reports that he is a program manager for Textron Defense Systems in Wilmington, Mass. He also is a selectman in North Andover, Mass., having served in that position for the last nine years,—Edwin G. Eigel, Jr., Secretary, 33 Pepperbush Lane, Fairfield, CT 06430; Joseph P. Blake, Jr., Assistant Secretary, 74 Lawrence Rd., Medford, MA 02155

55

George Rubissow reports from Paris that he continues to work on industrial development and foreign trade in Europe while he is also growing premium quality grapes in the Napa hills of California. His objective is to make the best Bordeaux-style, Cabernet Savignon, and Merlot red wines in the Napa Valley.

Alan Boardman gives us a complete family rundown. He was elected group vice-president—Administration at Aerospace Corp. in El Segundo, Calif. Of his children: Lina joined Prudential Bache as a vice-president and account executive, Rebecca is tentatively entering real life in San Francisco after completing an art program at UCLA, David will be in medical school this fall, and Miriam is studying theater arts at UC-Irvine.

Martin Shooman will have the second edition of his book *Probabilistic Reliability* published this year. Martin is living in Glen Cove, N.Y.

That's it for this time. I hope everyone had a good summer and will be ready with more information for Bob and me to put in the column.—Co-secretaries: Robert P. Green, 37 Great Rock Rd., Sherborn, MA 01770; DuWayne J. Peterson, Jr., 201 E. 79th St., New York, NY 10021

56

The Los Angeles Course XVI Class of '56 Comandos held their 31st annual holiday get-together at the home of Joan and Dave Mitchell in Redondo Beach last January. Others present were Joan and Gerry Sozio (the founders), Barbara and Bob Stapleford, Fritzie and Fred Culick, Mary and Bob McDonald, and Jean and Haig Parechanian. All are OK; do not send money. . . . Kreon L. Cyros: "Classmates, drop by and say hello pext time you are at M.I.T."

Wallace P. Mack III has become an independent telecommunications engineer and has won a contract with the FBI for microwave system research and design. Wallace is located out of Vienna. Va.

As one of your class secretaries, I received a note from a classmate complaining that he had been solicited twice in the same year by the Alumni Fund. I have heard the same comment from others when I have been involved with telethons out of New York City and Boston. (Editor's note: Joe Collins, Alumni Fund director, explains that the fund year runs from July 1-June 30, so it's possible to be called twice within the same calendar year. He would be happy to hear specific concerns or answer questions about the solicitation program.)

Mini-reunions: We wish to thank **Dave Mitchell** for sending in the XVI get-together news. It is good to hear that some of us get together on a regular basis. Every five years there is talk of class mini-reunions in off years at locations other than Cambridge and talk of class, course, and M.I.T. reunions in several cities, states, and areas. Your class officers will be glad to provide

whatever assistance (classmates in your area, etc.) we can, and we will be glad to use these class notes to provide interest and publicity (within the three-month lead time required).

Looking forward to hearing from you.—Cosecretaries: George H. Brattin, 39 Bartlet St., Andover, MA 01810, (508) 470-2730 (won a new area code without moving a finger); Irwin C. Gross, Sweet's McGraw-Hill, 1221 Ave. of the Americas, NYC 10020, (212) 512-3181

57

Members of the class will be saddened to learn that James J. Coles, of Boston, died on October 24, 1987. He was 59 years old and is survived by two daughters, two sons, and one grandson.

Melvin Cohen has become manufacturing research and development vice-president for AT&T. Melvin is responsible for the Engineering Research Center, the Manufacturing Development Center, and the Manufacturing Software Center. He is also the chairman of AT&T's Manufacturing Technology Grants Committee as well as president-elect of the IEEE Lasers and Electrooptics Society.

Raymond Auyang has retired as vice-chairman and chief executive officer of Tau Laboratories and remains as a consultant and director of the firm. He was one of the founders of Tau Laboratories, which was purchased by Du Pont in 1986. . . . Leo Hood retired from Metropolitan Edison Co. and is now a consultant on small PBXs. He writes that he has 13 grandchildren.

John Psarouthakis delivered the commencement address at Eastern Michigan University's commencement exercises in April. He is the founder, chairman, and president of J.P. Industries, Inc., and has been active in support of higher education. At Eastern Michigan University, he is chairman of the Center for Entrepreneurship Advisory Board, a member of the College of Business Development Board, and chairman of the planning committee of the President's Forum. He is a member of the advisory council at Carnegie-Mellon University and the development committee for the M.I.T. Corporate Leadership Award.

Sanders Associates awarded Alan Budreau the Sanders Book Award for his paper, "Electrostatically Variable SAW Decay Lines—Theory and Experiment," published in the IEEE Transactions on Sonics and Ultrasonics.

Julian Cherubini writes that he is looking forward to our next reunion in Bermuda. The last was perfect. He is now going through the trauma of sending his oldest daughter, Nicole, to college. His youngest has six years to go until college, so Julian will enjoy PTA and AARP simultaneously.—John T. Christian, Secretary, 23 Fredana Rd., Waban, MA 02168

59

We are now less than a year away from our 30th reunion, which will take place the weekend of next June 9-11. It seems like just yesterday that we enjoyed all the activities of our 25th. They say that as one gets older, all the years just seem to blend together and rush on by. Speaking of getting older, I attended the 50th-birthday bashes for several of our illustrious classmates. The most novel of which was the one given for Barry Weinberg by his wife, Lynn, who hired a repertory group to put on a "This Is Your Life—Barry Weinberg" at an avant-guard theatre in Soho. Over 100 of Barry's friends were there. Barry was enticed to attend thinking he was going to a mime group performance. Needless to say he was taken quite by surprise, and he was reminded about things relating to his days at the Institute that I'm sure he thought no one would remember. The evening also featured the tasty wares of the lady tacos pushcart vendor with the flaming red "Mohawk" and aqua spandex

leotards who provided the victuals.

If any of you experienced unusual celebrations of your half-century natal day anniversary, please send them along so we can all enjoy.

Ron Stone writes that he had a pleasant visit with Landa and Rick Hall at their new home in Manhattan Beach. Rick is currently employed at The Aerospace Corp., in Washington, D.C., in senior project management and doing a considerable amount of travel. Their son Ricky, an M.I.T. alumnus, is teaching reading in the Bay area. . . Jon Weisbuch writes to tell us that he was appointed by the governor of Wyoming to be the director of the state's Department of Health and Social Sciences in December 1987. His family has moved to the West, where "the skiing is great as is the scenery." . . . A recent note from Bill Long states "I am group product manager for engine oil additives with Chevron Chemical Co. My job takes me to most places in the world and has plenty of challenge. My wife Carol and I have lived in Novato, Calif., since 1970 and have one child (age 7) at home, and two (21 and 24) mostly on their own"

Dave Weisburg informs us that he is now director of the Federal Systems Group at Auto-trol Technology in Denver.

Larry Laben writes that he has returned to Stamford, Conn., with IBM in Westchester after five years with IBM in Tokyo. "Talk about culture shock." He goes on to say that his wife, June, is busy transferring her Japanese antiques gallery back to Stamford. His daughter Nancy is now an attorney for IBM in Chicago, and Gaby is in direct-mail marketing in the D.C. area. "No more tuition bills."

The final note this month is from Tom Crystal who writes, "I have just completed a two-year term as president of the 13,000-member IEEE Acoustics, Speech and Signal Processing Society. I will be chairman of the IEEE Technical Activities Board Development Committee's Administration." Tom has been with IDA in Princeton, N.J., for 15 years. His son Michael graduated last June from Course VI-A. His next son Paul is a freshman at the University of Michigan, and his daughter Susan is in her last year of high school.

The mail basket has been lean for the past few months, so as an incentive for you to drop either me or Ron a note, I am offering to send a copy of the 25th-reunion picturebook free to the first 25 classmates who send us some news that we can use in the class notes.—Arthur J. Collias, Cosecretary, 24 Hemlock Dr., Canton, MA 02021

60

I open this column with a reminder from your class agent—we are now in a new Alumni Fund year, and I again ask you to be generous. As I write this in early May, our participation for the 1987-88 fund year is only 35 percent, but I am hoping that last minute contributions will bring us close to 50 percent.

From Middlesex (Mass.) News comes word that after 12 years on the Holliston Conservation Commission, the last two as chairman, Joe Cohen has decided not to seek reelection. Joe, who is with Natick Labs, has had a lifelong interest in conservation and ecology. He also is a researcher, photographer, and painter of covered bridges and publishes a magazine, Covered Bridge Topics. . . . Rich Hedrick lives in Arlington, Va., where he pursues a career that includes industrial chemicals and computer systems. Rick says he can meet just about any personal computer computation need.

I've heard from **Hugh Morrow**, now residing in Greenwich, Conn. Hugh is the new executive director of the Cadmium Council, Inc., and is also doing market development for zinc and lead.

A few weekends ago I got a call from Jaime de Sola, who has returned to the States after 21 years traveling the globe (Curacao, India, Venezuela, Holland, and the UK) for Royal Dutch Shell. Jaime and Madeleine moved to Manhattan

after he got "an offer I couldn't refuse" to be Amerada Hess' vice-president for strategic planning and control. (Jim just can't get the oil out of his veins.) The de Solas' three children have remained in Holland attending university and high school.

Robert White, Control Data's chief technical officer, has been appointed to Minnesota's Science and Technology Committee. Established by the state legislature, the committee will provide policy advice both to Minnesota's Office of Science and Technology and the Department of Trade and Economic Development.

Finally, I recently had lunch with Marc Weiss who was visiting the Pentagon in line with his duties with the navy bioengineering lab in New Orleans. I enjoyed seeing Marc although, unfortunately, we both had other appointments that kept us from too much reminiscing. . . . I hope you all have a pleasant, fun-filled summer.-Frank A. Tapparo, 15 S. Montague St., Arlington,

Pete Buttner sent me copies of three "cancer updates" he has been sending out to friends over the last couple of years. The gist of the story is that in October 1986 a group of painful lumps in his jaw were found to be metasteses from a diffuse squamous cell tumor in his throat. That kind of tumor is inoperable, so he began a series of chemotherapeutic and radiation treatments at Yale. These have been successful and he thinks there is a good possibility of cure. In any event he retired from his job at Boise-Cascade in Brattleboro, Vt., and now plans to motorcycle across the country visiting favorite places and people. I hope he will keep us up on his progress-both physical and medical. His letters and "updates" are unfailingly interesting and upbeat. Quite an inspiring story. Thanks, Pete.

Ben Turetzky writes: "With the merger of Uniroyal and Goodrich Tire, we have moved again. This time up to the Akron area. I serve as vice-president of sales and marketing for Ameripol Synpol Division of the Uniroyal Goodrich Tire Co. We are the largest domestic producer of emulsion SBR. The family is adapting well to Hudson, Ohio. Our daughter Jill started her freshman year at the University of

Pennsylvania this September."

Well, that's the news from here. I appreciate your letters and look forward to many more.-Andrew Braun, Secretary, 464 Heath St., Chestnut Hill, MA 02167

We have received word from New York that Dwight A. Kellog has been promoted from vicepresident—finance and controller of New York Telephone to vice-president and controller of the

parent corporation, NYNEX.

Bob Anderson dropped us a short note from Phoenix with a copy of the Wall Street Journal article announcing his promotion to president and CEO of GenRad, Inc. He said that "...after a great 15 years in Arizona, Judy and I are relocating back to Massachusetts!" Bob was a Course VI-A co-op student with GenRad and joined the company full time in 1963. He left GenRad in 1973 and co-founded another company, which GenRad then acquired in 1980. Bob has held a variety of senior management positions with GenRad since then, and took on the top job this past January Bob and Judy have a daughter, Beth, who will be a junior at the University of Colorado in Boulder. Their son, Greg, will be a high-school senior in Massachusetts next year.

We received a nice article from M.I.T. Spectrum on our very own Edward H. Linde detailing his involvement in the redevelopment of Kendall Square in Cambridge. After attending Harvard Business School, Ed went to New York to work

with Tishman Realty and Construction. He returned to Boston in 1965 with Cabot, Cabot and Forbes, and then went out on his own with Mortimer Zuckerman in 1970. They formed Boston Properties, which now employs about 200 people in Boston, New York, and Washington, D.C. After some initial frustration with the Park Plaza project, they have developed close to 10 million square feet of new, mixed-use space in the past 11 years. Ed's company has about 70 major building projects in place in Boston, Cambridge, New York, and Washington, D.C. Some of Boston Properties projects include the Marriott in Kendall Square, Long Wharf Marriott Hotel in Boston, 599 Lexington Ave. in New York, and the Park Hyatt Hotel in Washington, D.C. As announced in an earlier class notes column, Ed and his Joyce have endowed the Edward H. and Joyce Linde Professorship Fund in Urban Development at M.I.T. "...to encourage research and teaching that focus on how urban development affects the lives of those who reside in and use cities."

Warren M. Zapol, M.D., professor of anesthesia, Harvard Medical School at Massachusetts General Hospital, wrote an article in the June 1987 issue of Scientific American on "Diving Seals of Antarctica." . . . Jerome E. Manning, Jr., dropped us a note with the proud announcement that his daughter, Patty, graduated from M.I.T. in June 1987, with an S.B. in mechanical engineering. So both Jerry and his daughter are alumni of the Course II program, 25 years apart. We hope that we can meet her at her 25th reunion when we are celebrating our 50th.

Theodore J. Sheskin dropped us a note that he was promoted to professor of industrial engineering at Cleveland State University in January. Ted teaches courses in optimization and probabilistic models. During the summer he works at NASA Lewis Research Center in Cleveland.

Richard S. Orr writes that he left his job as technical director for Stanford Telecommunications, Inc., in Reston, Va., in January after 11 years to join the staff of Atlantic Aerospace Electronics Corp. in Greenbelt, Md., to work in surveillance and intercept technologies. Rich is still playing the trombone whenever and wherever he can. He and Julie are the proud parents of a daughter, Anna Catherine, born December 18,

Keep those cards and letters coming in. If you can't write directly to me in Birmingham, please send your notes to Technology Review in Cambridge. The pipeline may be a bit slow but it is dependable.—Hank McCarl, Secretary, P.O. Box 352, Birmingham, AL 35201-0352

You can't always get what you want. I would like to be reporting all the activities of our gala 25th reunion, but I am writing in early May. So the

report will have to wait.

Congratulations to Robert Anderson (who got his S.B. in electrical engineering in 1962 but also graduated with us, receiving a second S.B. in industrial management). He has been promoted from senior vice-president to president, CEO, and COO of the world-renowned GenRad, Inc., of Concord, Mass. The advancement took place early this year, and is of course a real feather in his

Allen Meyer reports he is no longer chief of income maintenance at the Office of Management and Budget but is now a consultant to state governments on federal programs, a change he finds "interesting." We look forward to the further news he promises from "poolside" at 4230 E. Mountain View, Phoenix, AZ 85028. . . . Roy Komack has also changed jobs. He had spent 17 years at Bose Corp. but is now with Bytex in Southborough, Mass. a manufacturer of electronic matrix switches for WANs. He lives at 9 Countryside, Natick, MA 01760. . Jack Solomon is now associate director of R&D at the Linde Division of Union Carbide. He had spent a few years

at Semiconductor Research Corp. and was involved in the startup of a company called

On the academic side, Carl Dover has won a Senior Homboldt Award for study and research in Germany and was elected to the executive committee of the Division of Nuclear Physics of the American Physics Society. Congratulations, Carl. . . . David Claypool speaks wistfully of his days in Brussels, actually "nine wonderful years...where my wife and I met and started raising our family." They are now back at the Ethyl Corp. headquartered in Baton Rouge, La., but are looking forward to returning to Brussels.

Ralph Grabowski lives in Andover, Mass., and is a marketing consultant specializing in industrial capital equipment. He formerly spent six years as a microwave circuit designer and 18 years in marketing and sales.-Phil Marcus, Secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043,

(301) 750-0184

As I write, spring is in full flower here in Washington, D.C. The obvious signs are the hordes of tourists and the thick or thin letters from colleges arriving in the mailboxes of high-school seniors. Louise and I are getting psyched up for visiting Nashville, since our daughter Jennifer has opted for Vanderbilt starting in the fall.

The envelope of class news is pretty full with Alumni Fund contribution notes. . . . Mark Lappin is practicing intellectual property law as a partner at the firm of Lahive and Cockfield in Boston. . . . Col. Joe Boling is with the Defense Communications Agency in Reston, Va., with about another 18 months before a new assignment, "preferably in Japan." Joe is heavily involved in organized numismatics. He's the president of the International Bank Note Society and is a recognized expert in Japanese numismat-Bill Euerle is living in Foxboro, Mass., and working for Foxboro Co., where he is managing development of their X.25 gateway project. Bill spends all his spare time with his sons in Boy Scout activities.

More computer news. Jim Rome has started a PC software company that specializes in scientific graphics for IBM PCs. The company is called Scientific Endeavors Corp. and "is doing very well." . . . Tom Arnold is now working for AT&T as product management vice-president for their UNIX-based computer products. Tom, wife Carol, and sons Bill and Eric are living in Basking Ridge, N.J., and are getting used to being East Coast people again after 11 "excellent years" in Naperville, Ill. . . . Jeff Michel is working as a free-lance translator and computer consultant for manufacturing companies in the Black Forest, and is also pursuing studies in East Germany. He made his first appearance on West German radio last year with a 10-minute presentation on intra-German economic affairs. His work has been published in Studies in Comparative Communism. Jeff is now working on a book on East German environmental problems.

Former class secretary Steve Schlosser writes that he is now senior vice-president for business development for PCA, a small company that specializes in automatic testing and related engineering services. Steve is now living in Port Washington, N.Y. His sons George (18) and Lewis (16) are fine and "would make any parent proud." Steve says he needs to lose weight and get better organized. Maybe it's time to start the Great Class of '64 Pre-Reunion Weight-Off; I've got about 10 pounds that I wouldn't miss.

On the Institute news: Dean Ann Friedleander of the School of Humanities and Social Sciences, who received her Ph.D. in economics from M.I.T. in 1964, has been appointed class of 1941 professor in recognition of her scholarly achievements and leadership as dean. She joined the M.I.T. faculty in 1974 after holding various other teaching positions. Dean Friedlaender lives in Newton, Mass., with her husband, Stephen, and two sons, Lucas and Nathaniel. . Lita Nelsen is now a biotechnology specialist in M.I.T.'s Technology Licensing Office. She is involved in efforts to move inventions made by M.I.T. researchers into the commercial marketplace through interested companies. Proceeds from the licensing royalties are shared by the inventor, the associated M.I.T. department or research center, and the M.I.T. Corporation.

When you read this, we'll be less than a year away from our 25th reunion. Please plan on attending, but first, send some news of yourself so your classmates will know more about you before the reunion.-Joe Kasper, Secretary, 3502 Idaho Ave., NW, Washington, D.C. 20016

Charles Deane writes that in his shrinking spare time, he scribbles a few paragraphs and scours the woods around Glastonbury, Conn., for interesting trees. . . . Chris Ebbe married Patricia Gropitz in October 1987 in Salzburg, Austria. Congratulations! Chris writes from Cucamonga, Calif., (any Jack Benny fans in the audience?) that he's working on a book on self-esteem that he started even before the new fad hit in California.

Ron Newbower is still at Mass. General Hospital and has been appointed to the new position of director of technology development in the hospital's parent corporation to promote the development and commercialization of new biomedical technologies. Ron's also still an associate professor in the Harvard-M.I.T. Division of Health Science and Technology. . . . John Woods has spent the last year at the National Science Foundation directing their program in circuits and signal processing.

Ron Brinkerhoff's fund envelope either got coffee spilled on it while at the alumni office or came as deck cargo on a submarine, so I've had to decipher it a bit. As far as I can tell, after living "way out" for the last 18 years, Ron and Kris have moved into a lively community that sits along the Cincinnati beltway. Ron says the proximity to friends and school activities has really paid off for their two active children, Ellen, 7, and Josiah, 5. Kris and Ron never took a honeymoon, so this past spring they spent a week of "adult play" in the Caribbean-high time for a day in the sun after eight years of family visits.

A clipping from the Portland, Maine, Evening Express reports that Mike Efron has applied for leave from his position as principal of the Cape Elizabeth High School (for the 1988-89 school year) and applied for a new position as the curriculum director for the Cape Elizabeth schools. Good luck, Mike. . . . Jon Addelston is vicepresident of the Software Product Development Division of the Software Productivity Consortium in Reston, Va. The consortium's newsletter quotes him describing the division's first set of products.

It's spring now (lovely) but it will be near autumn when you read this. A word of warning. We'll have to talk soon about a successor for me, maybe before the reunion. Candidates should contact Steve Lipner, Secretary, 6 Midland Rd.,

Wellesley, MA 02181

I got a letter from Jim Kester reminding me of the times when the Beatles were new and the Burton House pool room never closed. Jim has just left the air force after 21 years as a meteorologist and programmer to various flying outfits. He is now working for SofTech, Inc., doing mostly government work, "having some fun while earning a living." Jim's daughter is a grad student at the local state university, and he also has an 8-year-old son. He keeps in touch with M.I.T. affairs by interviewing prospective freshmen in the Dayton area.

Matt Fichtenbaum is still senior principal en-

gineer at GenRad. He was featured in an electronics magazine article recently on Genrad's newest board tester. He still plays a lot of Swedish fiddle music and returned to Sweden last year to attend a music course. Matt, Judy, and Rachel (6) live in Chelmsford, Mass.

Last year Carl Jones joined Key Logic, a startup which makes high performance operating systems for S/370 machines. He was made vice-president of technology development shortly afterwards.

Barrie "Shuffler" Skinner and Court, '62, write that their daughter Nicole is enjoying her second year at M.I.T. (Baker House). Daughter Heidi is graduating from U. of California and will start law school. Son Loren will finish high school this year. Court is director of research at National Semiconductor, while Barrie is IC division manager at a Japanese firm, just to cover their bets.

Stephen Teicher has been at DEC for 19 years. He is now manager of a group that develops tools for field service. His wife Delly is manager of strategic planning for DEC's Educational Services Group. Wish him luck-next year he has four kids in college.

A newspaper clipping reports that David Wyss, who works at DRI, has become a source of expert information for reporters and newscasters who need words of wisdom on financial events for their audiences. He attributes his recognition to DRI's reputation and his own pleasure in explaining things to people.

Michael Leavitt is spending more time in Cambridge recently as a member of the National

Alumni Association Board.

For those of you who wonder, there is usually a three-month delay between the time I send these notes to Technology Review and the time we all receive them. It may take a while, but if you send something, the class will see it.—Jeff Kenton, Secretary, 7 Hill Top Rd., Weston, MA 02193

Robert Tameo has been named a co-finalist of the 1988 Donald F. "Truly" Warner Award by GE Aircraft Engines in Lynn, Mass. This award is the highest engineering award at GE-Lynn. Bob is manager of F404/MBE fan and compressor design at GE Aircraft Engines. . . . Yupo Chan is now deputy head of the Department of Operational Sciences at the Air Force Institute of Technology's School of Engineering. . . . Neil Steinmetz has been living in Palm Beach County, Fla., for the past nine years with his wife Ruth and sons, Jon, Adam, and Paul. Neil is an attending radiologist and chief of magnetic resonance imaging at IFK Hospital and has recently published a book on magnetic resonance imaging of the lumbar spine.

Bob Sullivan was promoted last year to staff director of business analysis of McDonalds Corp. ("How a Course VIII grad gets into the hamburger business is a long story!"). He and his wife have been married for 17 years and have two boys and a girl, ages 8, 6, and 3. . . . Travel is very much a part of Ruth Peterson's life as a professional astronomer. Last summer she went from a rafting trip in the Grand Canyon to a meeting in Paris to give an invited talk, and then to Chile to observe the southern-skies. Tennison is employed by Foxboro, Co. He and his wife, Pat, have two children, Jeff, 16, and Ashley,

Joseph Klawsnik proudly announces the birth of his daughter, Bethany Ramsey Klawsnik, on July 8, 1987. . . . Roy Gamse is vice-president of services management and marketing for MCI. He and his wife, Joyce, a docent at the National Gallery of Art, live in Washington, D.C., and have two children, Nicky, 5, and Laura, 3. Raymond Giglio writes that he has moved from Augusta to "even more rural living-Wayne, Maine, population 900." He is principal mechanical engineer with Central Maine Power.-Jim Swanson, Secretary, 878 Hoffman Terr., Los Altos, CA 94022

By the time you read this, our 20th reunion will be history, and it will be time to start planning for the glorious 25th!!

We have one birth to report this month. Melissa Paschow and Andy Seidenfeld have announced the birth of their son, Justin Philip, on July 6, 1987. Justin's delighted sister is Laura Brooke, who is now 7. . . . George and Harry Goldmark are practicing orthopedic surgery in New York City. Nancy and Harry are living in Briarcliff Manor with their sons James, 9, and Brian, 7. . . . From nearby McLean, Va., we hear that last June David Coomber has joined a startup company, Atlantic Aerospace Electronics Corp. The firm has offices in Boston and Washington and has many M.I.T./Lincoln Lab alumni.

In the Boston area, James Hsia has joined Cadela Laser Corp., a manufacturer of pulsed dye lasers for medicine and research, as vicepresident of R&D. . . . Morey and Tessa Orellana Gardner are still living in St. Louis, where she is director of Pediatric Infectious Diseases at St. John's Mercy Medical Center, and Morey is director of Infectious Diseases at St. Mary's Health Center. They are busy with their four children: Elliot, 9, Raquel, 7, Eva, 5, and Ari, 3. . . . In the fall of 1987, Paul Bente co-founded Merlin Instrument Co. in Half Moon Bay, Calif., to develop biochemical instrumentation. He reports, "It's been very interesting so far."

Moving from Boston to Chapel Hill, N.C., have been Lauri and Joel Tepper and their daughters, ages 8 and 12. Joel is now chairman of the Department of Radiation Oncology in the UNC School of Medicine. . . . Judy and Robert Dixon are living in Baldwinsville, N.Y., (near Syracuse) with their three children, ages 14, 12, and 5. Robert is completing 13 years with Crucible Specialty Metals Division as a product manager

for high alloy tool steels.

A cryptic note from Thomas Griswold advises that by the time this is printed his position in the Kentucky Energy Cabinet may be abolished, but so far it has enabled him to be still actually practicing geology. He has applied for certification by the American Institute of Professional Geologists and has earned his third degree black belt in Kiyojute Ryu Kempo. . . . Penelope and Eric Sweetman are living in Princeton, N.J., in a rural neighborhood across from the Delaware and Raritan Canal. Robert has been working at the AT&T Engineering Research Center for over five years and enjoys skiing, hiking, and keeping their "modest estate" in shape. Penelope is a writer of fiction and poetry.

James Legs, who works for IBM in nearby Manassas, Va., was one of six IBM employees to organize, along with 25 religious organizations, a stockholders' initiative at the recent IBM annual meeting urging that IBM cease sales to South Africa until apartheid ends. His views were presented in York Times. . . . Finally, we are saddened to report the death of Michael Lum on May 11, 1986. He was living in Dresher, Pa., and leaves his wife, May, and three children, Charlotte, Victor, and Aron. . . . That's all we have now. It's been a pleasure serving you for the past 20 years, and we hope you've enjoyed our work from time to time.—Gail and Mike Marcus, Co-secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

I'm impressed with the volume of notes that keep rolling in. Keep those pens working! David W. Brown writes from Andover, Mass., "After 12 years as a hands-on designer-builder, I have left the construction business to concentrate full time on my residential design practice, specializing in houses and additions in the Andover area." And moving from the ground up, Lt. Col. George C. Slusher (USAF) writes from Santa

Maria, Calif., that he is test director of the Anti-Satellite program which "has moved into a 'limited operational capability,' rather than being completed." He reports still working with a local pony club, "teaching young folks the joys of horsemanship." He adds, "Still unmarried, but now a 'senior,' (old) officer." . . . Henry I. Miller has been special assistant for biotechnology to the FDA commissioner. He writes, "The job is a crisis-a-minute but exciting and rewarding. I serve on a number of international panels addressing regulatory or public policy issues concerned with biotechnology and genetic engineering." Jeremy Rafkin, watch out for our class man!

Ioe Verducci has received tenure as an associate professor at Ohio State University in the Department of Statistics. Joe's wife, Barbara, is also at OSU in English education. The couple is building a house in Powell, just north of Columbus, "where our two daughters, Madeline and Ann, can pursue the terpsichorean arts." . . . John R. Smith writes from Palos Verdes Estates, Calif., wife, Vivien Dee, was promoted to associate hospital administrator at UCLA. And, "Our lawsuit versus the city was successful, and a championship N/S tennis court has replaced the weeds in back of our home." What's this, a man of my gender (apologies to Woody Allen)? "Due to lack of opportunities and inadequate compensation, I am actively planning an early retirement from aerospace." Beat you to it, John! . Varian recently published Intermediate Microeconomics with W. W. Norton & Co., which he describes as an undergraduate text book designed to prepare students for his graduate text, Microeconomic Analysis. He recently became one of three co-editors of American Economic Review, the major scholarly journal of economists.

Roger Chang writes from Columbia, Md., that his wife, Lula, and he have started a needlework design business called Wooly Dreams Design, and that they use a Macintosh desktop publishing system to support their work. Roger also has become treasurer of the AOC Professional Electronic Warfare Organization. . . And in the most "high-tech" accomplishment of all, Peter R. Busch and his wife report celebrating the birth of their third child, Luke, this year. . . Steven J. Pecsenye writes from Toledo, Ohio, "My software consulting firm, Woodley Rollins Associates, has grown nicely from six to 30 people in three years. It's the most exciting thing I've ever done."

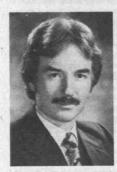
Roy Latham reports that he is now an engineering manager in Sun Microsystems in Mountain View, Calif. . . . Steven H. Maser has been promoted to rank of full professor in the George H. Atkinson Graduate School of Management of Willamette University in Salem, Ore. He has taught public administration and public policy there since 1978. . . . William P. Bengen writes, "After being a New Yorker for 40 years, I am trying the other coast. Moved the family here in December 1987, and we love it. I am going through evaluation of mid-life career changes after working in the family soft drink bottling distribution business since graduation. The pause that refreshes?" . . . Mark L. Braunstein is now president and chief operating officer of National Data Corp. in Atlanta, Ga.

Stephen T. Lee encapsulates his life since leaving Boston in 1975 and becoming a Californian: "I worked for Systems Control, Inc., in Palo Alto for four years and then Energy Management Associates for five years. I have been consulting for the Electric Power Research Institute. My wife, Agnes, and two children, Joyce and Kevin (9 and 7), and I live in Saratoga." . . . As for me, I'm here at the M.I.T. News Office writing about M.I.T. research, researchers, and the glory and controversies that occasionally swirl around them. The Quickening Universe continues to gather good reviews, and I'm now working on my second book, The Starflight Handbook -about prospects for interstellar flight. It is scheduled for publication in the spring of 1989 by John Wiley & Sons.-Eugene F. Mallove, 183 Woodhill-Hooksett Rd., Bow, NH

70

Sue Winard has moved from Kentucky to New York City where she is working at New York Hospital, Cornell Medical Center in the Division of Radiation Oncology. . . . Irving Asher is in Columbia, Mo., engaged in the practice of clinical neurology and runs an MR Imager in the dementia screening program in the Sleep Disorder Laboratory. His spouse is studying video and film production, and they live in a solar home designed by themselves. . . . Cynthia Blumquist, after ten years in Lexington, Ky., has moved to Harvard, Mass., and commutes to Boston where she works as the loss control supervisor for Home Insurance Co. She also is an associate director in the Liaison Program at M.I.T. She now manages marketing and sales activities and looks forward to the program's 40th anniversary.

David Asbell spent part of last summer kayaking in the Grand Canyon, his fourth trip. At Crystal Rapid, he and his kayak did two unintentional back flips. At Georgia Tech, he continues to manage the design and construction of the reflector and positioner for the world's largest "compact" radar range. . . . Harold Ting, spouse, and daughter have settled in Seattle. They now have a new son. Mr. Ting is the vice-president for marketing at Hillhaven Corp. in Tacoma. . . .



Steven Kruger

Steven Kruger has been appointed to the position of partner-in-charge of Arthur Andersen's New England Commercial Manufacturing Cortsulting Practice. He has been with the company for 15 years and formerly was involved in the western New York practice. He is a recognized expert in the design of Just-in-Time manufacturing operations and systems and other planning and development areas. He earned his M.B.A. from Wharton and is a CPA.

Raymond Kurzweil was named the Boston Museum of Science's 1988 New England Inventor of the Year. He is widely known for his computer-based equipment to translate print into voice and the spoken word into print. . . . Howard Manasse and wife are expecting their third child in July 1988. Howard is chairman of the Ophthalmology Department at St. Vincent Ambulatory Surgery Center in Erie, Pa. . . Sandra Wilcox has two children and is on the anesthesia staff at Madigan Army Medical Center in Fort Lewis, Wash. She has completed a fellowship at Harvard.

Daniel Galehouse is teaching at University of Akron while his spouse is performing molecular biology research at the Ohio Agricultural Research Station. They have three children. Howard Bluestein spent part of the summer in Taiwan running a Doppler radar for a meteorological experiment. While there, he visited Hong Kong and mainland China. He made the first close-up measurements of windspeeds in a tornado. He will appear on an ABC television program, Secrets and Mysteries. . . . Prakash Habalkar is currently senior vice-president of the new business unit at Tata Unisys, Ltd. in Bombay. He is also on the editorial board of the International Computer Law Advisor and consultant to UNC-TAD. He is actively involved in framing the government of India's national electronics and

computer software policies. He has been involved in business and technical management and consulting for 20 years.

Arthur Perkins, Jr. and spouse now have a second child, and Arthur has joined Ethyl Corp., in Baton Rouge as purchasing manager. . . . Wesley Moore is at Boeing in the Advanced Tactical Fighter Group. He writes that Dave Hall is still at Albert Einstein, and Marc Weinberg is at Draper Labs. . . . Charles P. Friedman has resided in North Carolina for 13 years and is an associate professor at the Medical School of Chapel Hill, where he directs a group that develops and studies medical computer applications. He and his spouse have two boys.

An obituary notice was sent to me by an alumnus in San Francisco. Paul C. Zimmerman died of AIDS at his home in April. He had been a computer systems analyst with the Bank of America and previously was employed by Rand.—Robert Vegeler, Secretary, Beers, Mallers, Bachs, Salin & Larmore, 2200 Ft. Wayne Bank Bldg., Ft. Wayne, IN 46802

71

John A. Malarkey writes: "Since 1987, I have been managing the Merger and Acquisitions Department at the Bank of America in San Francisco. My wife, Carol, and I have a daughter, Carissa (18), who is a freshman at Arizona State University, and a son, Matthew (3), a first-year student at Steppingstone Day Care. Carol is working at Stanford and attending school part-... John Calcagni writes: "I am still with the EPA. I recently was promoted to director of the Air Quality Management Division and am now in the Senior Executive Service of the U.S Government. My family (wife, Meg, and two children, ages 6 and 5) are doing well in North Caro-. Thomas T. Milkie is a manager of software development at Northrop Corp. and has finished his M.B.A. at the University of LaVerne.

Paul Snover is vice-president and general manager, Worth Systems, Boston Mass. He is married to Lydia Sultzman (Boston University, '71) and has three children-Matthew, Peter, and Emma Caroline. He spent the summer in Boston Harbor sailing a 23-foot sloop, Jai Christie. Janet E. Shields is working at Scripps Institute this year as president of the Optical Society of San Diego ("We're sponsoring a seminar on optics in education"). She is also a Brownie leader and is having fun raising the kids. . . . Michael P. Chrzanowski has moved to Houston, Tex., where he is a manager of heavy marine fuels for Chevron International Corp. He is married to Nancy Ann and has two children, Mary Ellen (8) and Peter (5).

Dwight A. Davis has spent the last year working on setting up a new company, Lockheed Technical Operations Co., which is a whollyowned subsidiary of Lockheed Missile and Space Co. . . . Thomas E. Nelson is vice-president of system development at Artificial Intelligence Corp. He will play a role in the development and release of the firm's new IBM mainframe-based KBMS expert system shell. Before joining AI, Nelson established and managed his own firm where he developed software for mainframes and PCs and provided consulting services to his . Leonard Tower, Jr. is working as a Unix wizard at Boston University and volunteering as the same with the Free Software Foundation's GNU Project.

Benjamin P. L. Feng writes: "After working with Citibank for 13 years, I have decided to join Hoau Govett, a U.K. investment bank and return to Taiwan as its country manager. I am looking forward to participating in the development of the capital market in Taiwan." . . . Eric Newman, Ph.D., has received the Eye Research Institute's Institute Scientist Award, and he plans to use it to investigate the theory that glial cells in the retina and brain help to control blood flow. Dr. Newman was the first to describe a process he termed

"siphoning" by which excess potassium is removed from the retinal extracellular space by retinal glial cells.-R. Hal Moorman, Secretary, P.O. Box 1808. Brenham, TX 77833

Cher and Marty Shinko were expecting a sibling for daughter Kelly (3) last June. Last we heard, Marty was a consultant while looking for a fulltime computer engineering job after layoffs at Control Data. Cher has been working part-time in a pediatrician's office. She recently had major surgery to correct a jaw misalignment.

Douglas Mahone is "still working as consulting architect in San Francisco, mostly energy work and research. Wife, Lisa Heschong (M. Arch. 78), has her own design practice. We have two kids, Amber, 7, Tyler, 4. We just bought a house and are fixing it up. Life is getting better in California." . . . From Chuck Ward: "Wish I could get paid for my volunteer work-am on the board of directors of the local United Way, the Boy Scouts, and two trade associations." . . . Faruq Ahmad writes from San Francisco: "I am responsible, as a partner, for the marketing/business end of a company that develops language compilers. After a decade in big business, running my own company is an immensely rewarding experience, filled with frustration, fun, hard work, and ultimately, the promise of freedom."

Donald D'Amico is director of the diabetic retinopathy unit at Mass Eye and Ear Infirmary in Boston. "With wife, Kathy, son DJ, 5, and daughter Laura, 3, I enjoy skiing and sailing as an escape from retinal surgery. In the lab, I am working on techniques for intraocular retinal glueing for complicated detachments." Michael Kotch writes, "In 13 years under the same employ, my company has changed its name five times and is now Unisys. I have worked on the Alaska pipeline, breeder reactor designs, supersonic rocket sleds, offshore oil exploration, subsea instrumentation, some outer space stuff, and communications equipment. Lots of neat toys to play with! My wife, Karen, and I are still building our ranch in Castaic, Calif., and we both were involved in founding a new city." Gorenstein "recently left academia to join the business world. I am a senior scientist at Millipore in the Waters Chromatography Division in Milford, Mass. Marion, Seth, and I will remain in Needham." . . . Marc Stern and his wife, Terrie, have two sons, David, 6, and Adam, 3, and live in Roslyn, N.Y. He has a private practice in cardiology and "would love to hear from the old gang."

Joe Litten is executive vice-president of Pacific Securities in San Francisco in charge of public finance and mortgage-backed securities. . Richard Solbrig has been appointed an associate in John Carollo Engineers, Walnut Creek, Calif. . Rox Anderson is assistant professor of dermatology at MGH and director of the Wellman Laser Biomedical Applications Lab. He is married and has a son, Jacob, 2. . . . Wendy and Ken Holladay had a son, Benjamin, on January 8. . . . Finally, Paul Lentrichia documents an interesting event: "Even though I am not through paying my M.I.T. loan, my daughter is applying for college, and I am considering her financial aid."-Dick Fletcher, Secretary, 135 West St., Braintree, MA

A few short notes to open this month's epistle. . Kalle Kang is in private practice of gastroenterology in Bellevue, Wash. . . . Scott Cutler was promoted last August to vice-president of software design with Tandy. . . . Sidney Henderson is beginning a two-year fellowship (also in gastroenterology) at Pitt. . . . Peter Stiller was recently promoted to professor of mathematics at Texas A & M. He will be spending the coming

academic year at the Institute for Advanced Study at Princeton.

. . Jonathan Schweizer is work-A bit wordier. . ing for EPA in Chicago, living with wife Sandy in Des Plaines. He is the facilities planning coordinator for all federally funded wastewater treatment in Ohio. . . . Robert Matson is a partner at Harvard Management Co. in Boston; he is also president of Financial Management Group, a company funding early stage companies. tia (Smith) Collins and husband Warren live in the Virgin Islands, with daughter Alexandra ('07). Portia is a senior systems analyst with the local telephone company.

Steven Warsof is a perinatologist at the Eastern Virginia Medical School in Norfolk, having lived there five years ("the longest I've lived anywhere since the AEPi house"). His third child, Elliot ('09), was born this past November. . . . Russell Dominique is working at Radix Systems in Rockville, Md.; he is special hardware division manager. Russ asks old MacGregor and Burtonites in the D.C. area to stop by.

Tom Lydon writes for the teenth time (got to meet that fella some time!); the Speedy Delivery man dropped by last August, bringing Maura Eileen ('09) to go with his other three. Tom is in his fifth year at Raytheon in Bedford, Mass., managing about 20 software engineers. This past February found him strapping on the hockey skates again in a 7-3 M.I.T. alumni victory over Caltech, and reminiscing about old Theta Chi superstars Dennis Intravia, Bill Billing, and Wes Grandmont. April saw him in the marathon for the sixth time. Did he finish? No word at press

Word has been received of the death in September 1985 of Daniel "Jay" Knighton. Our belated sympathies to his family and friends.

At this writing we are awaiting the results of the breakup of the Singer Co. and the ultimate whereabouts of your long-suffering correspondent. The subject of a takeover by Paul Bilzerian, my employer, is in the process of being split and peddled to the highest bidder, leaving me uncertain as to my future. We can hope my division (and my job-MIS director for the Allen Division) will stay intact through it all. Cross your fingers. Well, uncross them enough to write.-Robert M.O. Sutton, Sr., Secretary, "Chapel Hill", 1302 Churchill Ct., Marshall, VA 22115, (703) 739-8023

Your humble secretary received a bit more than one letter every other day this past month with news from classmates. In the words of Mae West, 'Too much of a good thing can be wonderful."

First up, Marc Rosenbaum. Marc has been named director of the Real Logs Home Design Center in Hartland, Vt. . . . Son number two was born January 1986 to Diane and Mark Webster. Mark has recently received his board certification in Orthopedics. . . . After 11 years in Atlanta, Jarvis Middleton is now director of Public Works for the city of West Palm Beach, Fla. He and Leanne have been married since 1982 and their daughter Laura was born on Christmas day in 1985. . . . Jack Liebschutz has been doing independent computer consulting since 1984. He is currently building a purchasing system for the city of Chicago. Nancy Lindsey, his wife, is also a computer consultant currently doing work at Amoco. They have three children-Betsy, Jacob, and Maggie. . . . Joyce and Chris DeMain have three sons and live in suburban Washington, D.C. Chris is director of business management for Martin Marietta's FTS 2000 project. . . . William Orchard characterizes his job as "real fun." He was recently promoted to product manager for identification systems at Hollister, Inc. Their thrust is patient identification and hospital information systems through the next decade.

People continue to brag about their kids. Take George Harper. Their (new) number two daughter, Margaret Helene, has red hair and blue eyes!

. Kenneth Miller is running for state representative in Ohio, emphasizing the need for new technology jobs and improved science and math education. . . . John Black is living in Pittsburgh and working in technology planning at Alcoa. He wants any alumni in "The Burgh" to feel free to call him. He's in the book. . . . News from the left coast finds Richard Hausman working as a communications software develoment engineer at 3Com Corp. in Santa Clara. . . . "Technical manager of a passenger ship company," writes Charalabos Psimarnos succinctly. Sometimes when I get so much mail I can put

Miller is president of a small company, Software Development Technologies, Inc. They are hoping to introduce some innovative programmers' tools late in 1988. He is also quite active in his church. . . Maybe he should call Dana Dickinson. Dana's moved to the D.C. area, primarily because she has accepted a marriage proposal from Arthur Halliday Laurent. Dana says, "It seems I have a knack for organizing things, so I've been mucking around in database applications de-

people together. Take these two: William M.

velopment. Anybody looking for such a beast? Eve Hollander finds herself and husband, Irwin, in Monsey, N.Y. "I'm still settling in and will look for work in a while." . . . Amos Oshrin is, I'm sure, not looking for work. From the town of Mountain View, Calif., Amos is now an independent consultant specializing in development of expert systems. . . . "Still working for a small pharmaceutical company (12 years!)" says **Beverly**Wilson, "and busy renovating the house we bought in Princeton (N.J.) last summer. Visited the M.I.T. campus for the first time since 1974. The view from my dorm (East Campus) sure has improved!"

As we get to the bottom of the column, you'll notice the letters get longer. Barry Buchbinder "finally" got married in January 1987. He and Isabelle were expecting a child in April. He's been learning French so that he can talk with Isabelle's family in Paris. At work, "we're still waiting for Lubrizol to decide the future of Agrigenetics. In the meantime, I've got lots of patents to write." . . . Donald Higgins is expecting their third child in October. He's working for Harbinger Computer Services in Atlanta. They have had some success in the electronic delivery of cash-management services with a product called "In Touch." Their current "hot project" is setting up a network for electronic delivery of business documents called "EDI" or "Electronic Data Interchange."

Amy Ng completed her Ph.D. at Caltech several years ago and has been at Dow Chemical in the San Francisco Bay area since then. . . . Saega Dil Vrtilek completed her Ph.D. at Columbia and is now finishing a postdoc at Goddard in Maryland. Suzanne Lim, after Columbia Medical School and a medical residency at St. Luke's, is now acting director of Employee Health Services at Memorial Sloan-Kettering in New York City. Janet Markham got her Ph.D. from the University of London, did a postdoc at Princeton, and has been at Western Electric and its successors ever since. She and her husband Michael have a daughter Joanna and a son Edward. Marjorie Yang is executive director of the Esquel Group of Companies in Hong Kong. She has a 5-year-old daughter, Dee. How do I know all this? Yee Wah Chin told me. Yee herself has been at Shea & Gould in New York City ever since graduating from Columbia Law School and is now a partner specializing in anti-trust counseling and litigation.

Remember, it takes six months from the day you write it to the day you see it in here, so write early and write often!-Lionel Goulet, Secretary, 115 Albemarle Rd., Waltham, MA

02154-8133

Greetings classmates, here's our news. David S. Kelly writes, "After three years doing technical

sales support for MASSCOMP, I'm moving over (as of February, 1988) to a similar position with Sun Microsystems—new horizons. I also just celebrated my ninth anniversary of marriage to my wonderful wife, Deborah—time sure does fly."

... Loren E. Dessonville is currently in his fifth year of partnership in the law firm of Kutak Rock and Campbell. With the recent acquisition of a lake cabin, he has taken up sailing, windsurfing, and fishing. His wife, Kathy, and he maintain residences in New York and Omaha. According to Loren, "United Airlines loves us." . . . Jeff Caruso has joined Archetype as vice-president of strategic architecture.

B. Anthony Isaac has been in Kansas for three years with Residence Inn. Marriott acquired the company in July 1987, and Tony and family will probably be moving back to Washington, D.C., this summer. He and wife, Michele, are the proud parents of three boys, Anthony (6), Peter (4), and Joseph (2). . . . Edward W. Capparelli, Jr. continues to work as a medical director for a health program providing care to Mishito Indians in eastern Honduras. A new son joined the family—Robert Edward joined older sister Elizabeth and brother Daniel on November 4, 1987. . . . Daniel B. Jones is currently working on a Ph.D. in the Mechanical Engineering Department at (where else?) M.I.T. He has a 2-year-old daughter.

Miles R. Fidelman is currently working for BBN Communications in Cambridge. His daughter, Tracy Ellen, was born October 22, 1987. . . . Todd Sjoblom had a baby daughter Elizabeth Oa Sjoblom, on March 29, 1987. . . . Congratulations to all you new parents! . . . Bruce L. Miller is a Q.A. manager for KAI, at Champaign, Ill., supercomputer software company. He's still trying to get his dissertation done part-time.

Harlan R. Davis writes, "In March, 1987, I turned my avocation into my vocation and began to pilot airplanes for a charter outfit. Since September 1987, I have been a first officer with Simmons Airlines, a regional carrier in the Great Lakes. Most interestingly, I, a management major, have joined the ALPA, the Airline Pilot's Association. It is true what we learned in Course XV, only management makes a union necessary."

I'll let that be the last word. Until next time.— Jennifer Gordon, Secretary, c/o Pennie & Edmonds, 1155 Avenue of the Americas, New York, NY 10036

79

Lots of exciting news this month. February 10 was the big day for our class president, Brenda Hambleton, and her husband John Hopper. That's the day that Laria Catherine and Riannon Elizabeth weighed in at 4 pounds, 4 ounces, and 5 pounds, 2 ounces, respectively. Accompanying the birth announcement was one of the most precious baby pictures I have ever seen. The proud mother had the following comments: "Being the parents of twins is not easy. You just get one happy and the other one cries. Our other big news is that we are about one month away from moving into our new home. We have spent the last two years building our house on 15 acres in Pepperell, Mass.

"Now it looks like we may need to build an addition to accommodate the new arrivals. John says next time we will have triplet boys—I say there won't be a next time!" Brenda points out that next year will be our 10th reunion. If you have any ideas for activities or would like to volunteer to help plan the reunion, please get in touch with her at her new address: P.O. Box 1253, 92 Nashua Rd., Pepperell, MA 01463; or call her at (617) 657-8048 or (617) 433-2005.

Jim Lester wrote with similar news. "Margie and I had our second child, Brian James, a 10-pound 10-ounce boy, on February 6. In addition, my Greensboro, N.C. law firm merged with a large (110-attorney) Washington, D.C., firm and is now the Construction Law Group of Patton,

Boggs & Blow." . . . George Paganis, who left Mobil in 1986 to join Pfizer Pharmaceuticals down the street, has made a bigger move this time—back to the Boston area. He is with GTE in Danvers, in strategic and financial planning. I hope to get more news from him soon. . . .

Dwight Davis sums up his situation neatly and succinctly: "Three kids, new business, major relocation, no time." Dwight and family live in Andover, Mass. . . Beverly (Schluckebier) Wright dropped a similarly brief note from Bear, Del.: "Housewife with son, 3 years, and daughter, 14

months. Enjoying myself!"

Christiane Tellefsen has made a big step. "After five years of residency and fellowship, I will finally be getting a real job! Beginning in July '88, I will be working as a staff forensic psychiatrist at Maryland's maximum security hospital. I have also opened a private practice in Baltimore. I'm fi-nally finishing school!" . . . James Thompson is a regional counselor for Theta Chi fraternity in his spare time, counseling chapters in Western Pennsylvania and West Virginia. He resides in Pittsburgh. . . . Keith Reid is "presently involved with Gospel Medical Missionary work, i.e., helping people to stay well through preventive medicine and also to get well using natural means. The goal: total health-mental, physical, spiritual. Drop me a line-I'll be happy to answer questions, or just hear from you. My address is: Rt. 1, Box 479, Seale, AL 36875." . . . Ron Lyons "recently packed up my family (wife and son) and moved to Maryland, near Washington, D.C. I left Hughes Aircraft to start a new job with a small consulting firm just outside of Washington."

Todd Peltzer writes that he is "in my second year of graduate study at M.I.T. I'll finish in June '89. After that, I'll continue my career in the navy with an assignment most likely at a naval shipyard-hopefully Pearl Harbor. In December 1986 I was married to Sandra Freitas." . Kulp announces, "My wife Lisa (Boston College 79) and I had a baby boy-Steven Daniel Kulplast December 1 (8 pounds, 15 ounces). Future M.I.T. material!" The Kulps and their little nerdin-training live in Framingham, Mass. . . . Eyad Abed "received a Presidential Young Investigator Award from the NSF last year. I have been promoted to associate professor of electrical engineering at the University of Maryland, College Also in College Park is Mike Osofsky. After spending a year as a post-doc, Mike has been hired as a research physicist at the Naval Research Laboratory, studying high-temperature superconductivity. . . . Gary Hebert is a consumer engineering manager for dbx in Newton, Mass. . . . Lee Weinstein is a medical staff fellow in endocrinology at the National Institutes of Health in Bethesda.

Richard Goldstein reports that he has "just completed one-and-a-half years as the first inhouse patent counsel for Sony Corp. Frequent trips keep me busy, but I am always happy to speak with alumni on the subject of intellectual property." . . . Andrew Kobayashi and his wife had a son named Matthew Hartman Kobayashi on October 23, 1987. . . . Susan (Morris) Colley put it this way. "When I asked my husband, Will (S.M. in E.E., '81) What have I been doing?,' he said, 'Worrying, Worrying about your research, and worrying about tenure.' I guess that's true. But my research (in algebraic geometry) has been okay of late and my tenure situation at Oberlin College doesn't look too bad at this point. I'll report again sometime later!" . . . Laura Hill had lots of years to catch up on us. "I got my degree from M.I.T. in January 1980, and spent sevenand-a-half years with General Electric working on aircraft engineering. In June 1987, I left G.E. and started a career in the chemical dependency field. I am now an alcoholism counselor in the social detox center in Wichita, Kans. I absolutely love my new job." . . . Mitchell Weiss wrote from Haverford, Pa. to announce two important "seconds." His second child, Adam, was born June 2, 1987. He also founded his second company, ProgramMation, specializing in flexible factory au-

M.I.T. ALUMNI CAREER SERVICES

Gazette

A listing every two weeks of jobs for alumni across the country

We want more firms to know they can list jobs in the Gazette

We want more alumni making a job change to know the <u>Gazette</u> can direct them to job opportunities

Whether you have a job to fill, or are looking for a job, let us send you a copy of the Gazette to show you how it can help you

Call or write
Marianne Ciarlo
Alumni Career Services
M.I.T., Room 12-170
Cambridge, Mass 02139
Tel: (617) 253-4735

tomation systems for the semiconductor and related industries. . . . Deb McKechnie writes, "I'm finishing up my Ph.D. dissertation at the University of Iowa. I was attending a wastewater conference in Philadelphia in October, and unexpectedly ran into Sue Hanson, "78, and Rick Kotosky, '80, on the exhibit floor. What an odd place for Bakerites!" (I don't know—I don't think Baker and wastewater are mutually exclusive!) . . Ed Hunter had nothing to disclose other than his address, which is Los Altos, Calif. Come on, Ed, you can do better than that!

My husband Robert Lustig, "76 (a.k.a. "77), gave me the surprise of my life for my 30th birthday. We came home from a nice dinner at the Four Seasons and found our apartment full of people having a party—for me! Among the 35 guests were Barbara Ostrov, "78; Lisa and Howie Boles, "76; Charles Mobbs, "78, and his wife Zita Wenzel; and Arnie and Lori (Ullman) Herman, "81. Joining the fun by phone were Iris and David Beyer, "77, and Monty Solomon, "78. It was so much fun, I think I'll turn 30 again next year! Until next time.—Sharon Lowenheim, Secretary, 500 E. 63 St., Apt. 18B, New York, NY 10021

80

WOW! I don't know what I said last month, but it did the trick. The class of '80 mailbox was positively STUFFED this month. So on with it.

Timothy Winsky resigned his commission in the navy last October and took a job with BASF in the Polyurethane Division, which supplies foam for the automotive industry. Along with the job change came a move to Detroit and a new house, which he really enjoys. . . Martin Patin writes that he returned to school full time in the fall of 1986 to study computer science. He didn't

name the school, but it's in California. (Scheduled graduation: June 1988.) By the time you read this, he should be gainfully employed in the software industry.

Not far from M.I.T., Joshua Herz has been en-joying life in Jamaica Plain for the past seven years with his wife, Ruth, and two great daughters. He is currently employed as a project engineer at United Electric Controls in Watertown, Mass., a manufacturer of industrial temperature and pressure controls. Also still in Massachusetts (and "never far from academia") is Paul Hajian, now teaching four courses a year in the design department at the Mass. College of Art. In addition, he returned to M.I.T. for a semester to teach the architecture department's collage class. In between all this teaching, Paul is attempting to practice architecture with his dad's firm in Rhode Island and Massachusetts. He says: "Recent restructuring of ancient apartment address will result in new Harvard Square inhabitation two floors up, with associated skylights, loft, deck, and cat. See-I am moving up in the world."

Alfred Picardi is an independent private consultant in environmental science. He formed Environmental Science and Assessment Services, Inc., which services insurance companies and industries in the environmental impairment liability field. In his spare time he is an FAA licensed pilot, certified scuba diver, and a member of the Soil Conservation Society of America and the Experimental Aircraft Association. . . . Also in the entreprenuer business is William Warner who, after four years as marketing manager at Apollo Computer, has started his own company, Avid Technology, Inc., based in Burlington, Mass. Avid is developing a new video editing system based on workstation technology. "It will do for video editing what the word processor does for text editing." (Was that free advertising?) . . . Recently Abraham Lederman also joined a start-up firm, Verity, as a senior software engineer. Verity develops document management software.

Howard Brand (hi, Howard) writes that he just finished his residency in internal medicine at Mount Sinai Hospital in New York City. In July he will be starting a fellowship in endocrinology at NYU Medical Center. . . Also a doctor, but of a different sort (guess...), is Namir Kassim, who writes that he is employed at the U.S. Naval Research Lab in Washington, D.C., as an NRC/NRL cooperative research associate (postdoc). He is currently using the VLA radio telescope in New Mexico to search for previously unidentified galactic supernova remnants. His area of specialization is low-frequency galactic radio astronomy. (Should I have capitalized that?)

Thanks to Debra Utko for the following news: Debbe is currently living in Armonk, N.Y., while she works for Pfizer, Inc., in New York City as manager of business planning for orthopedic im-plants. She writes that it's hardly "lifestyles of the rich and famous," but that she's not delinquent on any of her loans!" . . . Tabetha (Frey) McCartney gave birth to her second daughter in December (which updates the news from the last issue). Tabetha and family live in Newton "or some other suburb of Boston," and she is "into real-estate lending of major leagues." . . . Theresa Ravese is now a senior corporate planner at Pepsico in Purchase, N.Y. She recently traded in her condo for a townhouse in Ossining, N.Y. Another entreprenuer, Dean Phillips, and his brother John have been successful with their venture, Aristotle Industries. The business provides software/consulting to politicians and is now headquartered in Washington, D.C. Dean and John are also renovating a house near Capitol Hill

Carol Julin just received her master's in exercise physiology from the University of Wisconsin—Madison. She now works in the renal metabolism lab at the U.W. hospital. . . . More news from Michael Gennert: he and his wife, Kimberly, now have a beautiful baby boy, Eric Charles, born April 1, 1987. As previously reported, Michael is an assistant professor in computer science at Wor-

cester Polytechnic Institute. . . . Mark Zaretsky "finally" finished his doctoral thesis in November 1987. He now works on color copiers for Eastman Kodak in Rochester, N.Y.

My fellow fifth-year-reunion committee member, Marta Gross, writes that she just finished law school. "Going at night made it a long threeand-a-half years." She started a new career this spring when she moved to New York City. She is now working for a law firm that specializes in patent litigation. . . . David Smith M.D., is a fellow in cardiovascular disease at Thomas Jefferson University Hospital in Philadelphia. He has recently become board-certified in internal medicine. He and his wife, Christine, an optometry student, reside in Philly. . . . Barbara Hill received her professional certification and is now a registered architect. She is busy working on new Habitat housing for low-income families. She and Peter own a small home in Providence, R.I.-a "handyman's special."

Some additional short subjects: Mark Schlossman received his Ph.D. from Cornell recently and returned to Cambridge to do some post-doctoral work at Harvard. . . . Scott Kubowicz married Margie West, a Denver native, in May 1986. Scott and Margie live in Littleton, Colo. Scott is now in his second year of an internal medicine residency at St. Joseph Hospital in Denver. . . . We received a copy of a recent wedding announcement: Thor Hyppa married Patricia Foohey January 23 in Glastonbury, Conn. Thor is working for St. Equine Veterinary Services in Burlington, Vt.

Paul Homsy writes that he is still trying to complete a residency in psychiatry at the University of Texas. He expects to be finished in July 1989, after which he will decide what his next career goal will be. Psychiatry is far afield from his major at M.I.T., chemical engineering. Last year he made a trek to California where he visited Martin Prince and Lisa Masson, both in the San Francisco area. He believes that Martin is now back in the Boston area, while Lisa is pursuing a residency in Wichita Falls, Tex. Anyone have any confirmation of this information? Paul would be happy to hear from any alumni/future M.I.T. grads who pass through the Houston area.

We also received a letter from Charlie Freeman, who now lives in Charlottesville, Va. Last September, Charlie married Maureen McNulty, a woman he met in New Hampshire while associated with the M.I.T. Outing Club. They were married in Jackson, N.H. He now works as a flight paramedic for the University of Virginia Medical Center. He enjoys the change from engineering, but still keeps up with engineering by working as a programming consultant for a number of aeromedical transport programs around the country.

Finally, our last letter of the month comes from Terry Neiman, who's been very busy and living in southern California since leaving M.I.T. Some recent activities: visited Mexico, Egypt, and Israel; bought an old, Spanish-style money pit/house in Los Angeles ("Beverly Hills adjacent"); and made a career move by leaving TRW and joining Pacesetter Systems. His new firm makes pacemakers; he is the process/technology development and materials "maven." Terry is also in his fourth year as an educational counselor and would be very interested in hearing from anyone he's interviewed who actually attended M.I.T. (I hope you don't mention that philosophy prof we had freshman year!)

So...was that a big pile of mail or what?! Anyway, I think it's your turn next. . . . Looking forward to hearing from you! Enjoy the remainder of the summer.—Kate Mulroney, Secretary, 256 Hampshire St., #3, Cambridge, MA 02139

81

The recent campaign for mail has certainly been paying off. Many thanks to those of you who have written. Please keep those cards and letters coming!

Tom Barta recognized himself as being one of

the "less communicative." After five-and-a-half years in Rochester, N.Y. (at the University of Rochester), obtaining a Ph.D., Tom moved to Evanston, Ill., where he is a National Institute of Health post-doctoral fellow at Northwestern University in the area of natural products synthesis. He is currently interviewing with pharmaceutical companies. Tom says Chicago is great overall, he's listening to a lot of blues, Grateful Dead, and playing tournament bridge. Tom asks whatever happened to Chris Wheeler and Harry Martinez. (Please write!)

I received a nice letter from Jenny Ford. She was married to Dave Kinzer on October 14, 1987. in Paradise Valley, Ariz. The bridal party included Laurie (Christopher) Sprague, Maria (Tricomo) Rerecich, and Heidi Harvey. Other M.I.T. attendees included Nancy and Craig Stevens; Mary Finn; Wizzy Markham; Ed Kearns, '82; Suzanne Hirchman, '82; Ginger Harper, '83; and Carroll Dodson, '83. After the wedding Jenny and Dave spent three weeks in Europe. Highlights of the trip included watching the stock market and U.S. dollars crash, and breaking the windshield of a Porsche at 245 kph. Bak in Arizona, Jenny is working for Motorola Semiconductor in Mesa, where she heads up a BICMOS design and modeling group. In addition, she's doing some industrial liaison work for M.I.T. that includes interviewing VI-A co-op students. Nancy Saraf is doing the same for AT&T, which brings them both back to M.I.T.

Dave Pickner sends greeting from the Garden State (N.J.), where he is spending a lot of time at Bell Labs. Dave often sees Stephen Guattery, '80, and speaks with Janet (Grywacz) Davidson, who is selling for DEC in Culver City, Nev. Dave would like to hear from Bill Bug (nee Glickman) and his wife, Amy. . . . Lt. Fran Hall married Lt. William Schubert in October 1987. After finishing her MBA at Villanova in May 1988 (while stated in Norristown, Pa., as an NROTC instructor), Fran will transfer to Mayport, Fla.

Peter Waldo is still working with M/A-COM Government Systems (formerly Linkabit Corp). He married Carmen Bringas of the Republic of Panama in May 1986. . . . Tim Cleary was recently transferred to scenic Waco, Tex., as a manager of R&D process development of M&M/Mars. The move brought big changes to Tim's life as he traded in city living for suburbia and "even bought a lawnmower," and became engaged to marry Bonita Brubaker this fall. Congratulations.

Mark Fogel, M.D., claims to be living in marital bliss in New Haven, Conn., with his wife, Rani. Mark has recently completed his second year of pediatrics at Yale. He's currently waiting to hear from pediatric cardiology fellowship programs. Mark ran into a number of classmates on a West Coast tour in April 1987. . . . Andy Cohen and Denise (Dwonczyk) Cohen are living in Los Angeles. Denise is working for Jet Propulsion Laboratory and Andy is climbing the corporate ladder at TRW. . . . Ron LaSalvia is still in the navy and is engaged to be married. . . . Max Sirrine is a New York State corrections officer at Wallkill Facility. . . . David Jones received his S.M. from the University of Houston in chemical engineering and is working for ICI/TENSA Service in Houston. He travels overseas often for business, including England and India.

Julie Bernstein and David Borhani, '82, are happily married and living in Brookline, Mass. Julie is a post-doctoral fellow at Harvard Medical School in molecular biology. . . . Peter Balcewicz is working as a staff physicist at Hughes Aircraft Co. in El Segundo, Calif. . . . Stuart Anderson and his wife, Brenda, are enjoying the San Diego climate when they are not working at their respective start-up companies. Brenda's company is trying to break into the hazardous-waste business while Stu is working for a small firm attempting to capture the excymer laser market. . .

Jon Colton is an assistant professor of mechanical engineering at Georgia Tech, a school that Jon claims has "real" basketball and football teams and half-price season tickets for the faculty.

Jon married Rachael Graber, '87, last August and honeymooned in The Great White North.

Dennis Davis is living in Brookline, Mass., and working for Lotus Development as a software engineer in the Information Services Division. He and wife Courtney are expecting their first baby soon. . . . Kennita Warson is manager of Documentation Services at Qunitas Computer Systems, Inc., purveyors of Prolog compilers and development tools. Kennita claims to be a Libertarian candidate for Congress in California, pursuing a brown belt in karate, and will complete an MSCS at Stanford in September while looking for work related to a long-term goal of becoming an astronaut. . . . Martin Forrester received his Ph.D. from Harvard in 1987 and is now employed at Westinghouse R&D Center in Pittsburgh. He and wife Cathy are expecting their second child this summer.

Robert Close is doing research and teaching at UCLA, with occasional trips to Alaska to do ionospheric experiments. According to Robert, the aurora borealis is fantastic, but the nights are a bit chilly.

Arthur Lee is working for IBM in Los Angeles, where he currently supports the definition of the new USAF Space Command Satellite Control Network. . . . Willie Maddox claims to have written class notes for the first time. He's been with Clustergraph in Huntsville, Ala., for over four years helping to push mapping technology into the next generation. He is married with two children and has no plans for further education pursuits.

Danny Kon recently began a new job with TAMAM Precision Instruments (a subsidiary of Israel Aircraft Industries). Danny and wife Hallie are expecting their second child this summer. They live in Karnei Shomron, Israel, and invite anyone passing through to give them a call at 052-929889. . . . Anitta Bliss was kind enough to write regarding the missing-persons file. Anitta reports that I-Wen Huang is now I-Wen Connick after marrying Arthur Connick from M.I.T. She is working at Signetics and living in Belmont, Mass. . Anitta recently completed her master's in mechanical engineering at Stanford and is working for Apple.

Please keep those cards and letters coming. Also, feel free to include requests for "missing classmates." However, please remember that requests can only be printed when you include in-

formation about yourself!

I hope that everyone is doing well and is having a great summer. Please keep writing.-Lynn Radlauer Lubell, Secretary, 216 Beacon St., Boston, MA 02116

Finally, a letter! Gerald Fitzgerald wrote East Coast correspondent Linda Schaffir and reports that he's finished his MBA at McGill University in Montreal. He and his wife, Stacy, will be moving to the Philadelphia area, where he'll be working as principal scientific EDP analyst for Smith, Kline and French. While in school (concentrating on international business), Gerry commuted back and forth across the border for three years, becoming one of the very few people who can claim "having a crotchety customs official" as a reason for being late to class.

Linda spoke recently with Jonathan Cohen, who reports that he received his master's in pharmaceutical science from Rutgers University. bumped into Patricia Cullen on the T. By the time you read this, she'll be married to Scott Hathcock. Patty is back at M.I.T. working on a Ph.D. in materials science; she hopes to finish in

In case you've wondered, I do get the little notes you write when you donate money to M.I.T.-it just takes a few months. The rest of this month's news is from this source. . . . The Reporter of the Month award goes to Allegra Hakim, a captain working at the Air Force Ad-

vanced Composites Program Office in Sacramento, Calif., designing and prototyping advanced composite structures. . . She reports that Steve Nolet left the office and the Air Force in February and is back in Boston working for American Composite Technology, Inc., and that Young-Jae Kim married last September and now works for Apollo Computers outside Boston. . . . More news from Allegra: Eumi Pyun married last December and is finishing a Ph.D. at the University of Connecticut, and Juan Cruz is now M.I.T. staff working on the Deadulus human-powered aircraft. . . . Finally, she ran into Doug Finch at a composite materials exhibition. He is "apparently a Chief Big Shot" of Nuwuvi Composites, a small company being run by and for the Nuwuvi Indi-Many of these facts were also reported by Virginia Gozzo, who recently moved back to the Boston area and is working at MITRE Corp.

Don Abrams graduated from Harvard Law School last year and is now a corporate and tax lawyer at Bingham, Dana & Gould in Boston. Christopher Braun is in the army in Korea (2nd Infantry Division) doing communication "stuff," which he describes as "sometimes fun and exciting although mostly low tech." Chris will finish there within a year and probably head to Fort Monmouth in New Jersey to do some hig-tech research. . . . Tatiana (Carvajal) Padilla works at Bell Labs in North Andover, Mass., and owns a home in New Hampshire; in her spare time she scuba dives, skis, and canoes. . . . John Consla opened an engineering consulting firm in Kennebunk, Maine, last July. . . . Manuel Fernandez received his MBA in June and married Fay Yang the same month.

Garry Henderson got married a year ago and bought a house. He has received an award from Lockheed (his employer) for outstanding performance. . . . James Heintz and Bruno Mombrinie are partners in a medical products development firm in Philadelphia. . . . Alan Hollenback is still in the navy; he's currently an instructor of Cruise Missile and Fire Control System Employment at the Naval Submarine School in Groton, Conn. After 23 years of living in New Jersey, Josephine Lee has finally left the nest for sunny southern California. She's teaching English at California State University-Northridge, having received a Ph.D. from Princeton last August. Josephine reports that she enjoys "the earthquakes, mudslides, and Santa Ana winds," and that she's still

Rita Nothaft and her husband, Alfred Fordiani, moved back to Boston from New York City last fall. Over the previous summer, they had taken off three months to go hiking and mountain climbing in California and Washington (five peaks taller than 14,000 feet). Rita reports that she still works in water and wastewater/environmental engineering and Al works in horticulture. David Prugh is working in the electronics department of DuPont in Sayre, Pa.; he had previously worked for DuPont in Orange, Tex. and Parkersburg, W.V. David's son, Jacob, is 2 years old. Kim Vermeer is working for the Rhode Island Housing and Mortgage Finance Corp. as a housing program analyst.

Take a moment to write or call East Coast Cor-

respondent Linda Schaffir (18 Prospect Ave., Apt. B-2, Norwalk, CT 06850, (West Coast Correspondent Michelle Gabriel (656 S. Fair Oaks Ave., D-211, Sunnyvale, CA 44086) or me.-Stephanie Pollack, 33 Trowbridge St., Cambridge,

MA 02138

Hello once again fellow class of '83 members. By the time of this reading, our reunion will be a distant memory, however this is the last column written before our class gets together. The October issue will have stories about the major

Susan Blank is in the process of completing her pediatrics internship at Duke University Medical Center. From Duke, Susan will be heading to Yale University to begin her residency in pediatrics. Drop us a note when you get settled at Yale. . . . Michael Thompson simply can't get enough of the army life. He writes that he was supposed to finish up his term six months ago, however he is still stationed at the U.S. Army War College in Carlisle, Pa. Michael says he spends the majority of his time developing simulation models. He also is engaged to be married next summer, and his fiancee is in the army also. Karl Levy moved to California to take a new job in applied materials in new product development. He is extremely happy with the move. Michael McConnell is in his third year of med school at Stanford. He plans to be there until at least 1990, but he says he doesn't mind. He doesn't have too many expenses since he's on an American Heart Association Fellowship.

Lisa (Hartman) Dallas is currently employed with American Management Systems in Arlington, Va., in their expert system/AI group. I suppose she goes to the race track quite often because her husband trains throughbred race

Crystal Penn has left the friendly skies to move to Dallas/Ft. Worth. Her new job will be with American Airlines as a senior analyst. . thew Russel has decided to attend the M.B.A. program at Harvard University. However, he will not be doing it alone. His wife, Susan, and his two daughters, Leah and Claire, will be there to help him. . . . Carroll Dodson has had her fill of the Mormon culture of Salt Lake City, Utah, and has decided to move home to northern Virginia. Carroll left her job with Hercules Aerospace and has accepted a new position with Atlantic Research Corp. as a composite materials engineer.

I was worried that our Celebrity '83 column award might be putting unnecessary pressure on our classmates to do well and work hard...which is what everyone is supposed to do. I think it is equally important for everyone to enjoy life as much as possible. Because of this, I think this issue's Celebrity '83 should set an example of how to enjoy life to the fullest. Stephen Johnson has the right perspective on life. He recently took a four-month sabbatical from NCR and climbed the mountains in the northwest U.S., Canadian Rockies, and Alaska.

As for myself, I am still working with IBM. I should be getting out of marketing soon, however I do not yet know what my next assignment will be. I will live with Al Bashawaty, '84, who continues to take Morgan by storm. I think he does so well because no one knows what he is talking about. I will be going to Rome and England in June. While in England, I will visit Kevin Mazula, '81, whose wife, Sama, recently had their second child, Mariellena. Kevin asked me to be the godfather, so I will be going there for the baptism. I suppose I will have to learn how to talk with a raspy low voice. Keep the letters coming.—John De Rubeis, Secretary, 14 Charles Ave., Port Washington, NY 11050

I hope all of you had a very nice summer holiday-I'm sure some of you were traveling and want to tell the class all about the interesting places you went to. So please write and tell us all about it!

Paibow Malaisavariya writes, "I will be graduating from University of Southern California School of Medicine in the spring (1988) and will be doing my internship in internal medicine."

Robyn Coleman is a product marketing engineer for Solitec, a small but growing manufacturer of semiconductor processing equipment.

Tanya Segel says that she is graduating from Wharton (M.B.A.) in May and looking for a job

Thomas Hermitt got married in March and is working for DEC in Manhattan. His cat, Mr. Fuzz, is also alive and well. . . . Jeffrey Collett

''Madam, Let's Talk Bees''

By Kimberly French



Amy Smith, '84, and one of her African students work on one of her pet projects, beekeeping.

my Smith, '84, had one of the best weekends of her life, she claims, digging a schoolbus full of juniorhigh students out of a ditch in a 5-kilometer-long puddle during Botswana's rainy season—twice.

Smith, who in April was named African volunteer of the year by the Peace Corps, has been teaching math, science, and English in Ghanzi, a town of less than 5,000 in southern Africa's Kalahari Desert, since August 1986. Also acting as a coach, she was accompanying students on a sports trip the weekend of the double ditch mishaps.

Smith is one of more than 2,500 Peace Corps volunteers in Africa. Since the Peace Corps was founded in 1961, some 162 M.I.T. graduates have been members—six of them currently.

Even though the students arrived eight hours late and had to run their races alone against the clock as the sun was setting, and even though they had no water or food and couldn't sleep for the mosquitoes while they waited 10 hours for a tow truck to find them in the desert, they never stopped laughing and joking. When they

KIMBERLY FRENCH is a free-lance writer and editor in the Boston area.



arrived back home at 6 A.M. Monday, most still went to class.

It's a spirit she finds infectious. Tall, athletic, and effervescent, Smith herself brims with enthusiasm for the work that typically takes 15 hours of her day and most of her weekends. In addition to coaching and teaching four classes of 45 students each, she sponsors extracurricular clubs for math, science, business, and beekeeping. She also initiated the building of a hostel for Bushman students who had been living in a large cardboard box outside of town in order to go to school.

Her pet project is beekeeping, which she inherited from the previous Peace Corps volunteer. A mechanical engineering graduate, Smith knew nothing about bees before leaving for Africa. Even now, she says, "What I know about the theories of beekeeping would fit inside a bee." But she's a fast hands-on learner. In her year-and-a-half, Smith has organized three courses on beekeeping, captured a wild swarm, and is developing a hand-crank honey extracter for frameless hives.

While she hasn't used her mechanical engineering background directly, it's a useful thing to have, whatever you're doing, she asserts—just to know you can build something if you want. The most direct

application has been what Smith learned about polymers and resins at M.I.T., which has helped her in building numerous simple hives, including one with windows for observing the bees. The extractor she's working on will hold the comb steady while efficiently removing the honey, so the bees don't have to start a new comb. "Right now the kids just eat it all, and that's very efficient," she says.

For now, her beekeeping project is simply educational. When her Peace Corps term is up in December, she hopes to extend it another year to work with the Botswana Ministry of Agriculture on income-generating beekeeping projects in the swampy Okavango Delta, where there are more nectar-producing plants.

She also plans to get a master's in appropriate technology for developing countries. In her science club, her students made an electric arc reactor to make fertilizer, which she read about in a journal. "I wrote all my friends at M.I.T., but no one knew what it was," she says.

She figured out how to use an electric arc to fix nitrogen by combining it with water vapor to make nitric acid, which she then combined with wood ash to make fertilizer. That much was a success. The only problems were that birds ate most of

the seed fertilized with the nitrogen and goats ate all the plants that came up. Next term she plans an experiment to see whether hand, drip, or wastewater irrigation is most efficient for growing fruit trees.

Although Smith's excitement to share her stories of Africa paints a glowing picture of her work, there is a darker side. About one-fifth of her students are from the Basarwa Bushman tribe, who are looked down upon by all the other ethnic groups. The rest of her students are mostly from the Bantu tribe. Those who don't succeed in school often stay in town and turn to drink.

To help her students see there are choices, she has joined in efforts to interest students in trades, such as brick building, sewing, baking, and, of course, beekeeping. In her business club, government workers come to explain about grants and agencies that can teach students these skills. "They can take a two-week course and learn to run a bakery," Smith says, "and make a lot of money. Bakers charge \$1.50 for one loaf of bread, which in Botswana is a lot."

And the students respond. Some of her graduates started a beekeeping club in their high school. Many current students spend their weekends hanging out with her to learn more. "They'll say, 'Madam, let's talk bees.' And we do—for hours!"

Before joining the Peace Corps, everyone told Smith, "It's not what you expect." Now she finds herself saying the same thing to new Peace Corps volunteers. For one thing, she never expected to become a workaholic in rural Africa.

"There's nothing like the flash of understanding when they finally get the method in math class. And in Africa, they make a lot of noise, so you know. When they get it, it's 'eh-hey!' When they don't, 'Un-hunh.'

"My mother was a junior-high-school math teacher, too," she continues. "She always called us 'the kids' and her students 'my kids.' Now I understand exactly what she meant. They are your kids. They've put their brains in your care."

Jana Sample of the Boston Peace Corps office reports that the corps has a mandate from Congress to double the number of volunteers, to bring it closer to its size during the 1960s. She says that math and science teachers are in particular demand worldwide.

married Julie Ann Kern last June and expects to graduate with a Ph.D. in environmental engineering from Caltech in June 1989. . . Philip Kasten says, "About the only thing that hasn't changed in my life is my job—I still work at AT&T Bell Labs. Carolyn and I are now married and living in our new house in Nashua, N.H."

A few more graduate students: Geoffrey Campbell is still a graduate student at UCSB and hopes to be out by 1990. . . . Jonathan Ellman is a graduate student in chemistry at Harvard. . . . John Adams has "been working for the past year at the Johnson Space Center, developing robots for the space station. I'm dreading another Texas summer. Everybody come visit." Is that a blanket invitation, John? That's it for this month, folks—remember, please write in.—Mona Wan, Acting Secretary, 12231 Viewoak Dr., Saratoga, CA 95070

86

I only received one letter this month. This is very discouraging. Walid Nasrallah wrote all the way from Kuwait. He received his two bachelor degrees (Courses I and XVIII) in June 1987 and decided to stay for his master's. However, during Christmas vacation, Walid took his current job in Kuwait helping the Ministry of Public Works get a big palace built for the amir—this is the guy shown on TV welcoming back the hijack hostages in Kuwait. Walid is doing database programming until he decides to return to M.I.T. to finish his thesis. His roommate, Robert Krawitz also received his degree in June 1987 and went to work for Thinking Machines in Cambridge.

Hisashi Fujinaka is still in Japan learning the ins and outs of designing one-chip microcomputers to control VCRs and air conditioners. . . . Suzanne Eschenbach gave birth to her second child on December 11, 1987. It was a boy, John R.

K. Eschenbach.

Adrienne Ono married Scott Texter last August. Adrienne is in grad school in space physics at UCLA, and Scott works as a physicist at TRW. . . . Michael Bates spent last fall at Altus AFB, Oklahoma, installing new ADA software in a C-141B simulator. He's also been busy with his church (Fellowship Bible Church) and with politics (Republican precinct chairman and delegate to

county and state conventions).

Marian Sackler is doing well during her second year of med school at UT Southwestern. . . . Joy Hussain is having a great time traveling about South Africa during her vacation from teaching as a Peace Corps volunteer in Lesotho. . . . Bob Henshaw is in his second year of med school at Tufts University School of Medicine. He is one of the co-founders of the Medical Ethics Discussion Society, which is designed to prepare med students for real-life dramas now commonplace in clinical and hospital settings.

I spent a day with Lt. Marilyn Oberhardt at Hanscom AFB, Mass. We are working on a project slated to fly on the shuttle in early 1991.

. . Mary Bayalis planned to be married on May 28, 1988. She has finished at Berkeley and is living in Long Beach, Calif. Carl Resnik is working for GE in Natick and attending classes at M.I.T. . . Rod Lehman graduated from Sloan last December and currently works for Oracle in Belmont, Calif. . . . Katiy Kelly has finished up another semester of med school at Boston

University.

Rich Maurer was here in LA last week. He is completing his pilot training at Castle AFB, Calif., along with Noel Zamot, who is completing his navigator training. Both Rich and Noel will finally end up at Griffiss AFB in Rome, N.Y. Rich, myself, and Karl Tucker went to the Fox Inn in Santa Monica. Karl is still at Norton AFB, Calif., procuring those ballistic missiles for us along with Don Davidoff and Matt Phelps. . . . Chris DaCunha has been accepted at Stanford Business School and will begin there this fall. . . I hear that Brian Miller has received a raise at Bain & Co. . . . I ran into Jim Nugent at a party in Palos

Verdes, Calif. The air force is treating him well. I'll be off to Munich this month on business. The air force is treating me well, also.—Mary E. Cox, Secretary, SD/CLTP, P.O. Box 92960, LA AFB, CA 9009-2960

87

At last, beautiful weather. Can you believe that it almost rained the day of the Bahamas party? Lowell Kim and I made the best Bahamamass north of the Florida Keys. M.I.T. alumni came to our party from all over. Dan Kennedy and Sue Fields were in from California—they're both having a great time out on the West Coast. Dan is thinking of moving back to Boston next fall. Mark Emineth, '86, Dan Pine, '86, and Jim Manzi, '84, came in from Washington, D.C. Ed Savard (now stationed in the Albany area) and Dave Chen and Ken Corless (both working at Arthur Anderson) all made it from New York. Alan Hildibrand, '86, came from New Haven-Yale Medical School. Alan stayed with Brian Miller, '86, and Chris DuChuna, '86.

Jordan Levin and Reggie Grandea, '85, were also there. Reggie is leaving New England Bio-Labs to go to grad school in California this fall. Some other locals drinking Bahamamamas: Steve Cooperman, IBM, living in Framingham; Matt Kaplan, Cambridge Institute for Information Systems, living with Anthony Scotti in Cambridge; Jeff Klohr and Janet Zharadnick, both gradstudents at M.I.T., living in Somerville; Alan Gordan, Jim Clarke, and John Hamilton, sharing an apartment in Somerville (John will start work ing in Winchester soon for the Food and Drug Administration); Gene Cohen, Dave Maes, and Herman Reyes sharing an apartment in Somerville. They had a barbecue last week. Phyllis Kristal, Stan Oda, Bill VonNovak, and I almost had to put out a fire from their new hibachi.

Enough about the party. I spoke with Rob Hubal on the phone the other night, and he told me that he's been spending a lot of time in Boston at No. Six with his fiance, Elaine Cohen. Their wedding is planned for October. . . . Don Alvarez is also engaged—to Margaret Seymour, Wellesley. He will be graduating in electrical engineering and physics and will be working next year at M.I.T. in the Center for Space Research.

The Review office sent me more news Twietmeyer is studying pure math at marvard and will be taking a one year's leave to write Macintosh software. He also plans to spend a month in Germany this summer. . . . Roger Applewhite writes from Hermosa Beach, Calif. He's working at Allied-Signal Aerospace, the L.A. Division, and attending University of Southern California at night in electrical engineering. . . . Daniel Harasty writes from Long Branch, N.J. After finishing his course VI-A thesis in the summer of 1987, he went to southern Africa. He spent five months in Botswana, Zimbabwe, and Swaziland, working as a volunteer for the religious group, the Bahai Faith. Now Daniel is rank and file MTS at Bell Communications Research in Red Bank, N.J. working on end-to-end digital networks for the phone system of the future.

Geoff Kelsch is having a great time in San Diego. He'll be there until November, then Mississippi for about three months, and then to Long Beach, Calif., in March. Geoff saw Alex Lovett at a bar called "The Penant" in Mission Beach. . . . James Janosky and Jon Athow are on the ship, the U.S.S. Reasoner. . . . Tim Jones and Todd Malone are living in San Fransicso. . . . Hiroki Morizono wrote to invite the EAR crowd to a party...in Japan. He'll be there until September. Now he's doing "T.EM on dicotomosiphon tuberosus to see all sorts of cytoskeletal elements"

Well, that's all the news that's fit to print for now. Send me a letter—everyone wants to know what you are doing, Have Fun!—**Stephanie Levin**, Secretary, 3201 Eighth St., Charlestown, MA 02129, (617) 242-1618





Stanislav Jakuba

I CIVIL ENGINEERING

William J. Roberds, Sc.D.'79, writes from Kirkland, Wash., that he is an associate in the Seattle office of Goldar Associates, Inc., an international geotechnical engineering consulting firm. . Stanislav R. Jakuba, S.M.'70, has been elected vice-president of the U.S. Metric Association, a nationwide organization whose goal is to have the United States adapt completely to the metric system (SI—systeme internationale). Jakuba is president of S.R. Jakub Associates, a consulting firm in West Hartford, Conn. He is also an author, lecturer, holder of several patents, and advisor to industry and education on metric standards and changeover strategies.

Having completed his five-year commitment to M.I.T.'s Project Athena, Steven R. Lerman, '72, embarked on a one-year sabbatical on June 30 and will thereafter return to full-time teaching and research in Course I. As director of Athena, M.I.T.'s project to bring computers into teaching and learning throughout the Institute, Lerman takes greatest satisfaction in the fact that nearly 90 percent of all students now use the system. Gerald L. Wilson, '61, dean of engineering, expressed his thanks to Lerman for his role in transforming Athena "from a set of visions centered on education to an activity that has touched the educational experience of thousands of students. . . . It'will be a tough act to follow," Wilson said.

II MECHANICAL ENGINEERING

Professor Richard H. Lyon, Ph.D.'55, will conduct a 15-week advanced study program in machinery noise and diagnostics this fall under the auspices of the M.I.T. Center for Advanced Engineering Study. The text will be Lyon's new book, Machinery Noise and Diagnostics, and the course will meet first on September 12. Further information: Paul E. Brown, CAES, Room 9-335 (617) 253-6128. Lyon also has available on a loan basis, through his R. H. Lyon Corp., 60 Prentiss Lane, Belmont, Mass. 02178, a new video tape on advanced vibration diagnostics prepared by CAES.

Jeffrey K. Raines, Ph.D.72, is starting his 12th year as director of research and of vascular diagnostic services at Miami Heart Institute and the University of Miami Medical Center. . . . Jack B. Chaddock, Sc.D.55, was appointed associate dean for research and development in the School of Engineering, Duke University. He is busy this summer preparing to serve as chairman of a symposium on "Heat and Mass Transfer in Building Materials and Structure" for the International Centre of Heat and Mass Transfer to be held September 1-4, 1989, in Dubrovnik, Yugoslavia.

Allen Greenleaf, S.M.'64, a self-employed consulting engineer, has been elected to the Pownal, Maine, School Board. It was Greenleaf's first venture in search of political office, and he took a cautious approach on the election's major issuewhether to continue junior high classes or bus students to a neighboring town. . . . Joseph A. Wolf, Jr., Sc.D.'67, a staff research engineer in the Engineering Mechanics Department at General Motors Research Laboratories, Warren, Mich., has been named a fellow of ASME. Peter C. Huber, Ph.D.'76, is the author of Liability: The Legal Revolution and Its Consequences, to be published this fall by Basic Books. Huber, who is a member of the District of Columbia bar, is now a member of the staff at the Supreme Court. In the book he offers suggestions for dealing with the legal impasse of reduced coverage and higher settlements in tort law. . . . New materials and op-toelectronics are the subject of Alexander MacLachlan, Ph.D.'57, senior vice-presidenttechnology at Du Pont in a new collection on Productivity and Quality Through Science and Technology (Quorum Books, 1988). The book contains papers from seminars at Utah State University's College of Business that emphasize the role of technology in enhancing competitiveness.

Woodie C. Flowers, Ph.D.'73, who is famous for his innovation of the 2.70 design competition, and Roger D. Kamm, Ph.D.'77, an expert in biomedical fluid mechanics, have been promoted to full professors effective this summer. Flowers has been at M.I.T. since coming for graduate work in 1966, and he is a specialist in engineering design and biomechanics; Kamm came to Cambridge for graduate work in 1972, and he has done important research on fluid flow in blood vessels, the pulmonary system, and the eye. . . . Recognized for research in nondestructive testing in manufacturing processes, Ming-Kai Tse, Ph.D'81, has been promoted to associate professor at M.I.T. He joined the faculty in 1982 after one year with the American Can Co. in the field of productivity

Dwight M. Baumann, Sc.D.'60, director of the Center for Entrepreneurial Development at Stanford, spoke on technology transfer from university laboratories into industry at the annual meeting in July of the Council for the Advancement and Support of Education in Anaheim. . . Roger W. Schonewald, S.M.'84, is back at M.I.T. with a one-year Sloan Fellowship for graduate study in management; he has been a staff engineer in General Electric's Aircraft Engine Business Group, Lynn, Mass.

Keith Smith, Jr. '32, former president of the

J.M. Ney Co., precious metal processors, Bloomfield, Conn., passed away February 7, 1988, in Salt Lake City, Utah, at the age of 81. Smith served with the firm for 46 years before his retirement in 1977, when he moved to Green River, Wyo. He was president from 1964 to 1972 and thereafter chairman of the board.

III MATERIALS SCIENCE AND ENGINEERING

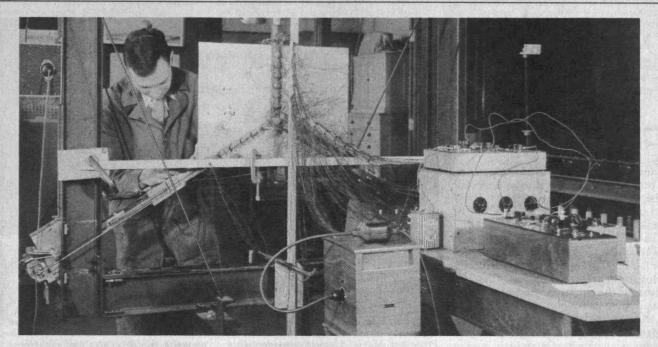
Three members of the M.I.T. community were participants in a special symposium on ceramic semiconductors at the 90th annual meeting of the American Ceramic Society in Cincinnati early in May: Uma Chowdry, Ph.D.'76, of Du Pont; Man Yan, Sc.D.'70, of AT&T Bell Laboratories; and Harry Tuller, director of the M.I.T. Crystal Physics and Optical Electronics Laboratory. . . . Among principals in the Federation of Materials Societies' 10th biennial conference on national materials policy in Fredericksburg, Va., early this summer: Peter R. Bridenbaugh, Ph.D.'68, vice-president research and development of Alcoa, who gave the keynote address; Robert A. Laudise, Ph.D.'56 (V) of AT&T Bell Laboratories, who led a workshop on policy issues in electronic materials; and H. Kent Bowen, Ph.D.71, of M.I.T., workshop leader on superconductor materials policy.

Four promotions are effective on the department's faculty at M.I.T. this summer: Gregory J. Yurek is professor of materials science and engineering; and Yet-Ming Chiang, Sc.D.'85, Michael F. Rubner, Ph.D.'86, and David A. Rudman are associate professors. Yurek has an international reputation in high-temperature oxidation and corrosion; he's been at M.I.T. since 1976. Chiang is associate professor of ceramics, Rubner associate professor of polymers, and Rudman associate professor of electronic materials.

Professor Julian Szekely of M.I.T. has completed three major publishing projects: he is coauthor of a textbook on Mathematical and Physical Modelling of Primary Metals Processing Operations, editor of the proceedings of an international conference on the same subject, and co-editor of Plasma Processing and Synthesis of Materials, the proceedings of an international symposium organized by the Materials Research Society. . . . Professor Heather N. Lechtman, director of the Center for Materials Research in Archaeology and Ethnology at M.I.T., was elected a fellow of the American Academy of Arts and Sciences.

IV ARCHITECTURE

Yusing Jung, M.Arch.'62, president and cofounder of Jung/Brannen Associates, Inc., Boston, has been named to the College of Fellows of the American Institute of Architects. His recent architectural projects include Monarch Place, Springfield, Mass.; and The World Trade Center, Boston. Jung is also a member of the Royal Architecture Institute of Canada and the Royal Institute of British Architects. . . . Stephen M. Carr,



wo international congresses in the United States this year are celebrating the 50th anniversaries of two little-celebrated M.I.T. inventions—strain gages and brittle coatings—that are the foundations of modern stress analysis.

The Institute's Patent Committee declined to pursue the so-called "bonded" resistance strain gage" in 1939. "The committee does not feel that the commercial use is likely to be of major importance," wrote Committee Chairman Edward L. Moreland, '07, who was also dean of engineering.

But the committee's crystal ball was faulty, "Hardly an organization in the modern world" is untouched by the strain gages—now called "load cells"—that are descended from the M.I.T. invention, says Peter K. Stein, '49. Stein is jubilee coordinator for the professional societies sponsoring the international meetings.

The resistance strain gage is an exquisitely simple device: it converts a small mechanical motion to an electrical signal by capitalizing on the fact that when a wire is stretched, its resistance is increased. When the wire is attached to a structure that flexes in response to stress, the change in resistance is a measure of the structural strain.

"The economic significance of load cells and electronic weighing in today's society is hard to exaggerate," says Stein. "They appear everywhere, serving as judge and jury over what you get and final arbiter over what you pay." Stein himself has specialized in the field since leaving M.I.T., first on the faculty at Arizona State University and more recently as an independent consultant and educator.

Strain Gages: After 50 Years: Once Rejected, Now Omnipresent

The inventor to whom Moreland's pessimistic evaluation was addressed was Professor Arthur V. Ruge, Ph.D.'39, now of Lexington, Mass., who taught civil engineering at M.I.T. from 1932 to 1947.

In parallel research in the same laboratory at M.I.T., Greer Ellis, S.M.'38, discovered the "brittle coatings" form of strain gages whose 50th anniversary is also being celebrated by the fraternity of engineers devoted to nondestructive stress analysis. Ellis's finding was also exquisitely simple: coat a rigid article, such as a section of an airplane wing, with an adhering film that becomes brittle upon drying, then apply stress. The film will first crack

The two M.I.T. inventions of 1938—brittle coatings and strain gages—enabled this 1942 civil engineering research on stress distribution in the gusset plates of steel structures.

Brittle coatings identified the stress points and strain gages measured the stress at each point. The researcher was Frederick G. Lehman, Sc.D.'60, who went on to become distinguished professor of civil and environmental engineering at the New Jersey Institute of Technology.

over the most highly stressed area.

Both Ruge and Ellis (it was the latter's 78th birthday) were among guests honored at the 6th International Congress for Experimental Mechanics hosted by the Western Regional Strain Gage Committee in Portland, Ore., last June, and they will also receive tributes at the 11th Congress of the International Measurement Confederation and annual meeting of the Instrument Society of America in Houston in October. Frank H. Hines, '39, chairman of RD F Corp., Hudson, N.H., planned historical papers for both meetings.

The program for Houston also included James Dorsey, '52, vice-president of Engineering Measurements Group, Inc., Raleigh, N.C.; Hans Meier, Sc.D.'39, retired from IBM Corp., Endicott, N.Y.; and Ferdi B. Stern, Jr., S.M.'40, retired from Magnaflux Corp., Wayland, Mass.

In Portland there will be reminiscences from associates of George S. Burr, '41, chairman, and Harold Hindman, '39, president of Instron Corp., Canton, Mass.; and Ralph Hayden, '33, retired chairman of Foxboro Co., Foxboro, Mass.

Ruge appears at both meetings on videotape, and there were tributes to such other pioneers as the late Given A. Brewer, '38, founder of Brewer Engineering Laboratories; the late Alfred V. DeForest, '11, a member of the M.I.T. faculty in mechanical engineering for a decade beginning in 1934; and Professor Emeritus William M. Murray, Sc. D.'36, of Georgeville, Quebec, who gave at M.I.T. the first U.S. collegelevel course that included strain gage and brittle coating technology and who is also notorious for his series of short courses in these subjects that began in 1953.

Cooper: Pursuing a Revolution in Graphics

First she was upset because most had no "content" value—just attention-grabbing, like a firecracker. "I found that very disturbing, because I had a powerful belief in the process of design—not as a decorative device, or as a neatening-up device, but as a way of thinking."

Then came frustration with what she called "the tyranny of the double page"—the fact that the largest unit of space available to most graphic designers is the split rectangle: the two facing pages of a maga-

zine or a book.

And finally there was the problem of correlating graphic design with the mechanical process by which it was reproduced. Graphic design students, for example, had "no understanding of the mechanics of printing, so they could not use the technology creatively. They were very far removed from the tools."

It was these frustrations, combined with an exposure to the vision of Professor Nicholas Negroponte, '66, director of the Media Laboratory, that 15 years ago gave Professor Muriel R. Cooper her inspiration for the Visible Language Workshop in the M.I.T. Department of Architecture.

In the beginning the workshop's major tool was an old offset press. Cooper and her students designed directly on the plates—no typesetting, no paste-up. "We were using the press as an interactive tool, so the kids could get a direct sense of how a machine and words and images could work together."

Then came Cooper's realization of the growing power and influence of computers. "When you talk about design in relation to computers, you're not just talking



Professor Muriel Cooper considers this three-screen graphic workstation a prototype for a multimedia design environment. On the left is "NewPaint," a program by Walter R. Sabiston, '89, that allows a designer to manipulate static and dynamic images simultaneously. At the center and right is "Packit" by Thomas Amari, S.M.'87, a package design program that rotates, opens, and closes packages imprinted with designs that can be varied in size and proportion while keeping a family graphic relationship.

about how information appears on the screen. You're talking," says Cooper, "about how information is designed into the architecture of the machine and of the language. You have different capabilities, different constraints and variables from those in any other medium, and nobody even knows what they are yet."

After 15 years as director of the Visible Language Workshop, that question still motivates Cooper, who this summer won the rank of full professor in the Department of Architecture. "This is a whole new world of design that nobody's even started to look at," she says.

Consider a book or a magazine, for ex-

ample. A conventional book offers different ways of linking information—references backwards and forwards, random-access devices like tables of contents and indexes. Cooper says, "the complex layering you can do on a computer offers a whole different way of browsing. If you can choose between movies and animation and straightforward graphics all at the same time, what kind of organization of information is now appropriate?

"We've opened up this sort of Pandora's box of information now, and unless we come up with some new ways to organize and design with it, we're going to have

nothing but chaos."

M.Arch.'61, reports that he is president of Carr, Lynch Associates, Cambridge, practicing architecture, landscape architecture, and urban design and city planning on a regional as well as a national basis.

Murial R. Cooper, who joined the M.I.T. faculty in 1977 after founding the Visible Language Workshop in 1973, has been promoted to professor of visual studies in the Media Arts and Sciences Section. She continues as director of the workshop, which is devoted to electronic and print media.

A one-man show of five paintings by **Tishan Hsu**, M.Arch.75, was a feature of the List Visual
Arts Center at M.I.T. in May and June 1988. After
finishing his M.I.T. studies, Hsu spent two years in
the Boston area before moving to New York in
1977. Now he has developed a style in which the
"contemporary reference is the electronic screen
with its particular spatial and temporal ambiguities," writes Dana Friis-Hansen in the catalogue for

the List Gallery show. But he uses a wide range of both conventional and unconventional materials to "couple fields of elusive imagery with passages of abstraction."

Reviewing the show, David Bonetti said in the Boston Phoenix that Hsu's works "create the ambience of a chapel, one where God is absent and information systems instead preside."

V CHEMISTRY

To Alexander Pines, Ph.D.'72, professor of chemistry at the University of California, Berkeley, the honor late last spring of membership in the National Academy of Sciences. . . . The National Science Foundation's prestigious Alan T. Waterman Award for 1988, to recognize outstanding accomplishments by a young researcher, goes to Peter

Schultz, NIH Postdoctoral fellow at M.I.T. in 1984-85. Schultz is associate professor of chemistry at the University of California, Berkeley. . . . To Sylvia T. Ceyer, Class of 1943 Career Development Associate Professor, M.I.T.'s 1988 Everett Moore Baker Award for Excellence in Undergraduate Teaching—an award that "means a lot to me," Ceyer told The Tech; "words don't do it justice." Ceyer also was honored last spring with the 1988 Recognition Award for Young Scholars of the American Association of University Women. . . Professor Mark S. Wrighton of M.I.T. is now a fellow of the American Academy of Arts and Sciences.

From Bay Village, Ohio, Aloysius F. Hepp, Ph.D.'85, writes that he is working on ceramic superconductors at NASA Lewis Research Center, Cleveland. Hepp has written articles on the subject for publication in Materials Research Society (MRS) Proceedings and Materials Research Bulletin.... Bruce K. Burnett, Ph.D.'82, and his wife Gail are both currently employed by Du Pont's Medical Products Department, North Billerica, Mass.

Charles M. Apt, Ph.D.'52, vice-president of Arthur D. Little, Inc., who was a specialist in electronic chemicals, thin-film resistors, and memory systems, died of heart disease on April 8 in Mas sachusetts General Hospital. Apt joined Arthur D. Little's Food and Flavor Section, Life Science Division, in 1954 after teaching chemistry at Amherst College for two years. In 1963 Apt left ADL to become associate director of the Exploratory Development Laboratory at United-Carr, Cambridge, but in 1969 rejoined Little's Food and Flavor Section. He later became manager of the Food and Agribusiness Section. Apt was also a consultant to ADL's Electronic Systems Section, working on the manufacture, application, and marketing of semiconductor devices.

Dorothy D. Thompson, Ph.D.'35, passed away in Jamaica Plain, Mass., on February 19, 1988, after a long illness; she was a victim of multiple sclerosis. No further details are available.

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Major IEEE honors for 1988 were presented in Boston early in May in connection with the annual ELECTRO/88 exhibition and conference, and members of the M.I.T. community were prominent in

the proceedings:

☐ J. Ross MacDonald, S.M.47, William R. Kenan, Jr., Professor of Physics at the University of North Carolina, received the Edison Medal for "seminal contributions to solid-state science and technology, and outstanding leadership as a research director. ☐ To Leon K. Kirchmayer, who studied in the Sloan School's Program for Senior Executives in 1975, the Lamme Medal for "pioneering work in

the operation and planning of electric utility systems." Kirchmayer is retired from major technical responsibilities at General Electric.

Robert M. Metcalfe, '68, chairman and senior vice-president-technology at 3M Corp. received the Alexander Graham Bell Medal for "the invention, standardization and commercialization of the

Ethernet local area networks." ☐ IEEE's Education Medal was given to Professor Alan V. Oppenheim, Sc.D.'64, of M.I.T. for "leadership in engineering education through teaching, textbooks, and videotape series in digital signal processing."

Three alumni have been tapped to be officers of the Boston Section of IEEE for 1988-89:

John K. Schindler, '59, will be vice-chairman, and Julian J. Bussgang, S.M.'51, and John G. Proakis, S.M.'61, will be members of the Executive Committee. Schindler is acting director of the Electromagnetics Directorate, Rome Air Development Center at Hanscom AFB, Bedford, Mass.; he has just finished service as chairman of the Electronics and Sensors Panel of Air Force Project Forecast II, a study to define technologies that will be most important to the 21st-century air force. Bussgang is a consultant, having been associated with Lincoln Laboratory and a founding officer of Signatron,

Inc., Lexington, Mass.

Proakis is chairman of the Department of Electrical and Computer Engineering at Northeastern University, where he has been a member of the faculty since 1969. . . . Pierre A. Humblet, Ph.D.78, associate professor at M.I.T., was an IEEE Boston Section speaker late last spring on the prospects for high-capacity optical networks; network capacity is now limited by the slow speed of the electronics in the terminals, he said. And Professor Jin Au Kong of M.I.T. and Robert T. Shin, Ph.D.'84, of Lincoln Laboratory were participants in a two-day IEEE Boston Section symposium on microwave remote sensing last June. Kong and Shin are co-authors, with Leung Tsang, Ph.D.'76 (now at the University of Washington, Seattle), of The Theory of Remote Sensing (Wiley, 1985).

Professor Joseph Weitzenbaum of M.I.T. was cochair (with Professor Inez Hedges of Northeastern) of a Northeastern University conference on cognitive theory and the humanities at Harvard late last spring. Weitzenbaum spoke at the conference on "Artificial Intelligence and Artificial Societies," and Professor Marvin Minsky of M.I.T. was a panelist following a showing of the movie, "Victim of the Brain." . . . Leonard M. Magid, Ph.D.'62, has been appointed vice-president for development of Electronic Systems Associates, the telecommunications consulting firm affiliated with Syska & Hennessy, New York. Magid is responsible for helping ESA client businesses upgrade their electronic systems to take advantage of the state-of-the-art technology. He was previously a principal of PA Technology, a consulting firm in Princeton, N.J., specializing in high-technology products and processes. . . John M. Cochran, S.M.'64, has joined Texfi Industries, Inc., Rocky Mount, N.C., manufacturers and marketers of various textile products. As vice-president and technology manager in Greenville, S.C., Cochran is responsible for research and development and technology strategies for all Texfi facilities. He formerly served as president of his own consulting firm, Cochran & Associates, and before that was executive vicepresident of Frontier Electronics, Inc.

Eight promotions are effective on the department's faculty at M.I.T. this summer: Arvind and John V. Guttag are professors of computer science and engineering; L. Rafael Reif is professor of electrical engineering; William E. L. Grimson, Ph.D.'80, and William E. Weihl, Ph.D.'84, are associate professors of computer science; and James J. Fujimoto, Ph.D.79, Hae-Seung Lee, and Martin F. Schlecht, Sc.D.'82, are associate profes-

sors of electrical engineering.

Two alumni have been named to new posts at Townsend and Townsend, specialists in patents, trademarks, and copyrights, San Francisco. Kenneth R. Allen, S.M.72, is a partner in charge of the firm's Palo Alto, Calif., office; and Robert A. Barr, '69, is a patent attorney in that office. . . . Leo E. Ramsauer, S.M.'69, has been appointed vicepresident and general manager of the Communications Systems Division of GTE Government Systems Corp., Waltham, Mass. Formerly Ramsauer served as corporate vice-president and president of the Government Systems Group at Scientific Atlanta, Atlanta, Ga.; earlier he had been with GTE Government Systems for 23 years and had worked at Bell Aerosystems and GTE Home Entertainment Products. He is a director of the Government Division of the Electronic Industries Association. . . . Professor Jack D. Cowan, S.M.'60, of the University of Chicago and W. Daniel Hillis, '78, of Thinking Machines Corp. were speakers at a Hofstra College symposium last spring on "The Legacy of John von Neumann" to mark 100 years of American mathematics.

Armand R. Tanguay, S.M.'51, writes: "Celebrated my fifth year of retirement last January 1. Have never been busier nor enjoyed life more! With my wife, Cathy, of 40 years, am working to help people spiritually and materially, and I also consult for our son's steeplejack/church restoration company. We thank God each day for health and new opportunities." . . . Another retiree is Frank P. Zaffarano, S.M.47, who left Gould Inc.'s Recording System Division, Cleveland, on his 67th birthday (November 1, 1987) but was called back in January for a special project. Zaffarano writes that he is "still grateful for the experience of working with the M.I.T. Radiation Laboratory and Research Laboratory of Electronics (1942-1947).

From Patras, Greece, Basil S. Proimos, S.M.'58, reports his many and growing list of professional commitments: since 1977 professor of medical physics and director of the Medical Physics Laboratory, University of Patras; since 1982 government representative to the European Community on matters of biomedical engineering; since 1986 rector (president) of the University of Patras; and since 1987 representative of Greek rectors to the "liaison" committee of rectors of the European Community universities. . . . The European Community also figures in a report from Karl I. Selin, Sc.D.'55, Enebyberg, Sweden: at the age of 65 he

has retired after 12 years' service as EC representative at the Joint European Torus Fusion Project in England. Now he maintains an office in Stockholm as consultant to other hydrogen fusion projects and he "enjoys the small farm we have on the island of Gotland in the Baltic Sea.

Rajan Batta, Ph.D.'84, is teaching in the Industrial Engineering Department at the State University of New York, Buffalo; researching innovative applications of operations research techniques.

VI-A Internship Program

June culminates the academic year with gradu-ation and awards ceremonies. The graduation academic procession was led, this year by Chief Marshal Raymond S. Stata, S.M.'58, who was concluding his term as president of the M.I.T. Alumni Association.

Traditionally VI-A'rs have received many of the honors and awards, and this year proved no

exception.

First of all, our own Ms. Lydia O. Wereminskiwho needs no introduction to any of you-was presented a prestigious James N. Murphy Award at the May 4th Institute Awards Convocation. The Murphy Award is presented to an Institute employee "whose spirited contributions to the Institute family have won a place in the hearts of students." The president's wife, Priscilla K. Gray, made the presentation of a citation and a lovely engraved Paul Revere silver bowl. Lydia served me in an exemplary way during my 18 years as VI-A Director and is continuing to do so for the present Director. As Kevin O'Toole so aptly put it in his letter to our VI-A companies telling of the honor: "All of us here at M.I.T. are delighted that Lydia's dedication over the years has been so suitably recognized. As they say in the TV ad, 'She won it the old-fashioned way-she worked for it."

The annual EECS Departmental gathering was held at Boston's Museum of Fine Arts on Sunday evening, May 15. Included among the 18 prizes awarded were six to VI-A students: for excellence in teaching, Jae K. Kim, S.M.'88, the Harold L. Hazen Award, and Ruth Y. Shyu, S.M.'88, the Carlton E. Tucker Award; sharing the George C. Newton Prize for best undergraduate laboratory project of the year was **Kenneth Lu**, '90; Honorable Mention in the David Adler Memorial thesis competition went to Lucene L. Tong, '88; and the Department Head's Special Recognition Awards went to Michael B. Parker, '89, as president of the student organization "Six Appeal" and Whay C.

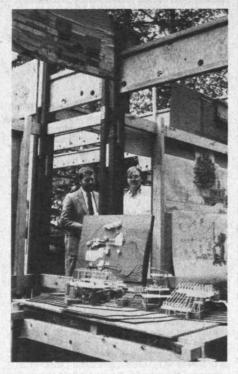
Lee, '88, for the LIDS semi-socials.

Other awards from outside the department included: Honorable Mention to Clifford K. Yang, Ph.D.'88, in the Writing Program's engineering writing competition; sports recognition awards to Roderick T. Hinman, '89, Malcolm G. Kispert Award as a scholar-athlete, Kai-Yee Ho, '89, and Philippe P. Laffont, '89, for tennis, and Timothy W. Mattox, '89, for his service as president of the Athletic Association; and military awards to Scott F. Fullam, '89, Pershing Rifles Regimental Commander's Award, Franklin F. Graham, '89, Navy ROTC Sailing Award, Mark E. McDowell, '88, The Washington & Franklin Medal of Sons of the American Revolution, and Joseph M. Morgan, S.M.'88, the Naval Submarine League Frederick B. Warder Award.

This year saw the awarding of the first Bose Foundation Fellowship for graduate study in EECS, established by Professor Amar G. Bose, Sc. D. 56. Winner was Mavis K. Lee, '89, and runner up was Carl A. Waldspurger, '89, both VI-A'rs.

Concerning present VI-A's, Director O'Toole reports: 65 received their degrees at the May 27th Graduation Exercises, having completed all their company and academic requirements, and, when you read this, 252 will be nearing completion of their 1988 summer work assignments.

VI-A continues as a strong component of the EECS curriculum! . . . William R. Thurston, S.M.48, announced he will retire from the leadership of GenRad, Inc., following 45 years of service. He started there as a VI-A student in 1941 when it



Brookline's Lars Anderson Park became a laboratory for M.I.T. design students last spring. With support from the city and several other sources, students in Professor Jan Wampler's graduate design studio planned a series of possible new developments to revitalize the area—amphitheater, restaurant, and other amenities. In the picture graduate student Timothy Mansfield (right) shows his concepts to Paul Willis, director of the Brookline Parks Commission.

was known as the General Radio Company. Another VI-A'r, **Robert E. Anderson**, '63, was named president at this year's annual meeting.

I recently received notice of the election of **John** W. Jarve, S.M.'79, to be a general partner of Menlo Ventures, Menlo Park, Calif. Another general partner of that firm, H. DuBose Montgomery, Jr., S.M.'72, has just been elected a member of the M.I.T. Corporation.

A communication from Dennis L. Polla, S.M.'80, tells me he has joined the Electrical Engineering Department faculty at the University of Minnesota after spending a short time with Yale University. He received a Presidential Young Investigator Award in 1986, but with the microfabrication facilities at Yale not materializing he made the transfer to Minnesota. He received the Outstanding Faculty Teaching Award (from among the science and engineering departments) for the 1987-88 academic year at the University of Minnesota. Congratulations Dennis!

Several alumni/ae have come by the VI-A office for enjoyable chats. John V. Burroughs, '82, was in from Data General, Westboro, Mass.; as were Denice D. Denton, '82, assistant professor, University of Wisconsin, Madison; David G. Lau, S.M.'86, Newton, Mass.; and Daniel M. Sable, '80, a Research Associate at Virginia Polytechnic Institute, Blacksburg, Va. It was a coincidence to discover that Dan worked with an acquaintance of

mine at RCA/Astro who served with me on the National Board of Directors of the Eta Kappa Nu Association back in the late 1950s.

This article is being written during the week of Technology Day activities. I expect to run across many VI-A alumni/ae at the activities on Friday, June 3, 1988, and will report on them in the next issue. Meantime, your letters and notes are most welcome.—John A. Tucker, Special Assistant to the Department Head, for VI-A and Lecturer, M.I.T., Rm 38-473, Cambridge, MA 02139

VII BIOLOGY

Maurice S. Fox, Lester Wolfe Professor of Molecular Biology at M.I.T., was honored by election to the National Academy of Sciences late last spring. ... James Rothman, a postdoctoral fellow in the department at M.I.T. from 1976-78, will become professor of biology at Princeton on September 1. John M. Essigmann, Ph.D.'76, who took his M.I.T. degrees in toxicology (Course XX), was guest speaker for the M.I.T. Club of the Connecticut Valley in Northampton late last spring; his topic: environmental carcinogenesis. . . . To recognize his contributions to the advancement of biotechnology, Arnold L. Demain, professor of industrial microbiology, has been elected a fellow of the Institute for Biotechnological Studies And Ira Herskowitz, of the University of California School of Medicine in San Francisco, has been named a fellow of the American Academy of Arts and Sciences

Three members of the department at M.I.T. have been promoted to the rank of associate professor, effective this summer: Steven J. Burden, whose work is in the fields of protein chemistry, cell biology, and neurobiology; Earl Ruley, a specialist in oncogene function; and Richard A. Young, an associate of the Whitehead Institute whose work is in molecular genetics.

VIII PHYSICS

An important new honor for James P. Gordon, '49, a consultant to the technical staff at AT&T Bell Laboratories: Gordon was elected to membership in the National Academy of Sciences late last spring.

George D.J. Phillies, Sc.D.73, associate professor of physics, has been granted tenure at Worcester Polytechnic Institute. Phillies is a specialist in the applications of quasi-elastic light scattering, and he has most recently developed a new theory that describes the movement of large biological molecules in solution."

Edward Coomes, Sc.D.'38, is currently assistant professor (since 1986) in the Department of Economics at Notre Dame. From 1983-86, Coomes was ESRC postdoctoral fellow in the Department of Applied Economics at the University of Cambridge, England. . . . Sol Aisenberg, Ph.D.'57, of Natick, Mass., has formed a new consulting and publishing company, specializing in carbon technology, medical devices, and high-temperature superconductors.

Sidney Altman, '60, professor of biology at Yale, has been named a fellow of the American Academy of Arts and Sciences.

Institute Professor Emeritus Herman Feshbach, Ph.D/42, of M.I.T. was honored by a two-day symposium in his name and three Herman Feshbach Lectures by Nobel Laureate Hans A. Bethe in Cambridge late last spring; together the programs reflected Feshbach's commitments to theoretical physics and to physics-related issues of science policy. For the theme of his third lecture, Bethe took Einstein's observation after the first atom bomb: "Everything has changed except the thinking of man, and what we have to work for is to change the thinking of man." But that does not imply, Bethe said, that "the Russians are just like us.... The past cannot be forgotten, but we must

not think that everything has to remain the same for all time. The future can be different." Among the speakers, in addition to Bethe: William Bertozzi, '53, Kurt Gottfried, Ph.D.'55, Cyril M. Harris, Ph.D.'45, Francesco Iachello, Ph.D.'69, Steven E. Koonin, Ph.D.'75, Earle L. Lomon, Ph.D.'54, and John D. Steinbruner, Ph.D.'68 (XVII).

The year 1987 featured three "super events" in physics, and to brief the nation's science writers on one of them—supernova 1987A—the National Association of Science Writers and the American Institute of Physics picked Kenneth Brecher, Ph.D.69, of Boston University. Brecher spoke at a reporters' seminar in Washington on April 18.

Two promotions become effective this summer in the department at M.I.T.: A. Nihat Berker, '71, is now full professor, and Janos Polonyi is associate professor. Berker, whose graduate degrees are from the University of Illinois, is a specialist in polar liquid crystals; Polonyi was trained in his native Hungary before joining M.I.T. in 1985 to work in the field of strong interaction physics.

The Du Pont Co. has provided a unique gift of \$10,000 in discretionary funds to M.I.T. professor **John D. Joannopoulis**; the grant recognizes Joannopoulis' pioneering work on theoretical modelling of real material solids, and he will use the funds for further research in this field.

X CHEMICAL ENGINEERING

Albert Sacco, Jr., Ph.D.'77, of Holden, Mass., has been promoted to professor of chemical engineering at Worcester Polytechnic Institute. Sacco's research interests are primarily in the field of catalysis, and he founded a NASA-funded center at WPI to study the feasibility of growing zeolites in space.

Robert S. Langer, Sc.D.'74, professor of bio-chemical engineering at M.I.T., and Laura Ann Feigenbaum, a fourth-year Ph.D. student in neuroscience at M.I.T., were married July 31, 1988. They live in Somerville, Mass. . . . Harold A. Ricards, S.M.41, writes that since retiring in 1982 as marketing manager at Exxon Co. U.S.A., he has moved "back to home" in Houston and has lived and traveled in Europe 30 percent of the time. . Michael J. Snow, Ph.D.'86, of Newton Highlands, Mass., is a member of Polaroid's film imaging research project, working with silver halide emulsions for the development of innovative consumer and industrial film products. . . . The American Academy of Arts and Sciences honored Samuel W. Bodman, Sc.D.'65, president of Cabot Corp. Boston, by electing him to the grade of fellow late last spring.

Two members of the faculty at M.I.T. have been advanced to the rank of full professor in the department, effective this summer: Robert C. Armstrong, a specialist in the rheology and fluid mechanics of polymeric liquids, and Jefferson W. Tester, Ph.D.771, an authority on geothermal

energy.

Ralph Landau, Sc.D.41, consulting professor of economics at Stanford, has been elected vice-president for a two-year term of the National Academy of Engineering. . . . To Howard Brenner, Willard Henry Dow Professor of Chemical Engineering at M.I.T., the 1988 American Chemical Society Award in Colloid or Surface Chemistry. To recognize the award, Brenner delivered a special M.I.T. lecture on "Macrotransport Processes"—the subject for which the award was made—late in May. Also this spring, Brenner was awarded a Guggenheim Fellowship for 1988-89 with which to pursue further studies in macrotransport processes.

Two deaths have been reported to the Alumni Association, with no further details available: Lewis D. Etherington, Sc.D.'71, of San Diego, Calif., on November 14, 1987; and Harry A. Raddin, '36, of Richmond, Va., on December 6, 1987.

XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

The honor of election to the National Academy of Sciences came late last spring to Robert E. Dickinson, Ph.D'66, of the National Center for Atmospheric Research, Boulder, Colo. Dickinson is acting director of NCAR's Atmospheric Analysis and Prediction Division.

Three faculty promotions are effective in the department at M.I.T. this summer: Kerry A. Emanuel, Ph.D.78, is now professor of meteorology, Glenn R. Flierl is professor of oceanography, and Leigh H. Royden, Ph.D.82, is associate professor of geology and geophysics. On the faculty since 1981, Emanuel has pioneered in studies of mesoscale storms using principles of fluid dynamics. Flierl is a theoretical physical oceanographer who came to M.I.T. after completing his Ph.D. at Harvard in 1975. Royden's work is in the field of geophysics—specifically basin analysis.

Ken Larner, Ph.D.'70, of Evergreen, Colo., will join Colorado School of Mines as the Charles Henry Green Professor of Exploration Geophysics, Golden, in late August. Larner is currently vice-president of geophysical research at Western Geophysical Co., having joined the company upon completing his work at M.I.T. Larner is president for 1988-89 of the Society for Exploration Geophysics. The Green Professorship at CSM was established by Cecil ('23) and Ida Green; it's named in honor of Green's father, who brought the family from England to North America in 1902.

An interesting summer for James W. Murray, Ph.D.73, profesor of oceanography at the University of Washington. He returns August 1 from leading a joint U.S.-Turkish expedition of more than 100 scientists from seven countries to study the chemistry, microbiology, geology, and circulation dynamics of the Black Sea.

XIII OCEAN ENGINEERING

Capt. Graeme Mann, N.E.'60, USCG (retired), was elected to a three-year term as selectman in Stratham, N.H., early this year; he's been a resident of Stratham since 1977 and serves as a lieutenant in the town's volunteer fire department.

... Cdr. William A. Dewey, O.E.E.74, USN, is currently repair officer, Trident Refit Facility, Bangor Submarine Base, Washington, D.C. Dewey is responsible for 900 people performing incremental overhaul, modernization, and repair of Ohio (SSBN-726) class submarines.

Without the participation of M.I.T. alumni, the programs for the centennial celebration of the American Society of Naval Engineers in Washington last May would have been almost empty. Among those present: Lt. Cdr. Ronald J. Booth, N.E.'67, USN (Ret.); Allen G. Ford, S.M.'54 (XVI); Norman O. Hammer, '58; Rear Adm. Frank C. Jones, S.M.43, USN (Ret.); Capt. Gilbert J. Kraine, N.E.'58, USCG (Ret.); Donald J. Liberatore, Oc.E.'77; Rear Adm. Malcolm MacKinnon III, N.E.'61, USN; Capt. Edmund B. Mahinske, '48 (VI), USN (Ret.); David M. Maurer, S.M.'79; Rear Adm. John H. McQuilkin, S.M.40, USN (Ret.); Rear Adm. Wayne E. Meyer, S.M.'61 (XVI), USN (Ret.); Capt. Virgil W. Rinehart, N.E.'54, USCG (Ret.); Benton H. Schaub, Jr., '68; Vice Adm. Benedict L. Stable, N.E.56, USCG (Ret.); Capt. Joseph S. Stoutenburgh, '48 (VI), USNR (Ret.); Lyssimachos A. Vassilopoulos, N.A.'68; and Rear Adm. Harold L. Young, S.M.'60, USN.

XIV ECONOMICS

Joseph E. Stiglitz, Ph.D.'66, professor of economics at Princeton, was elected to the National Academy of Sciences late last spring. . . And at about the same time, the honor of election to the

American Academy of Arts and Sciences came to Professor Oliver S. D. Hart of M.I.T.

A new assignment for Thomas F. Theurkauf, Jr., '74: he's been named director of investor relations for Shawmut National Corp., Hartford, Conn. Theurkauf will continue as vice-president of Connecticut National Bank, a principal subsidiary of the new super-regional bank holding company. . . . John R. Coleman, whom many readers will remember as professor of economics from 1949 to 1955 and later president of Haverford College, is now a New England innkeeper. Two years ago, at age 64, he bought the Chester Inn, Chester, Vt. In a Boston Globe interview last spring, Coleman admitted to losing "large amounts of money" during the first year. "But I'm doing OK now," he told the Globe's Carol Stocker. "I'm very close to the point of breaking even.

Professor Robert M. Solow of M.I.T. is a member of the Carnegie Corporation's new Commission on Science, Technology and Government, whose task is to recommend how science and technology can be more effectively used by all branches of government. . . . James M. Poterba, who came to the M.I.T. faculty in 1983, has been promoted to the rank of professor effective this summer. Poterba is a specialist in public finance and taxation; his degrees are from Harvard and Oxford. . . . Jean Tirole, Ph.D'81, professor of economics at M.I.T., will use a 1988-89 Guggerheim Fellowship award for further research in industrial microeconomics.



Barbara Rust Baksh

XV MANAGEMENT

Formerly product group director, Henry Hawley, S.M.'74, of New Canaan, Conn., has been promoted to vice-president—marketing of Seagram Beverage Co. . . H. Lees Hales, S.M.'80, has been appointed national director of computer-integrated manufacturing at Coopers & Lybrand, New York City. Hales served previously as director of the company's SysteCon Division working on a wide variety of computer and automated systems. . . . Ronald J. Bohm, Ph.D.'75, has joined the information technology consulting practice at Ernst & Whinney, Chicago, as a senior manager; responsible for developing a national executive information systems consulting practice for the firm and an expert systems consulting practice in the firm's Midwest region.

From John H. Halford, Jr., S.M.40, in Ft. Myers, Fla.: "Happily retired in this lovely village near Sanibel Island but still have our camp on Keyar Lake in western Maine. . . . Rear Adm. Ronald J. Zlatoper, S.M.'75, USN, who was selected for promotion to his present rank in December 1987, is currently serving as the chief of staff to Commander Seventh Fleet and residing in Yokosuka, Japan, with wife Barry Lane and two children, Ashley and Michael. . . . From Sterling Heights, Mich., Daniel Beardslee, S.M.'86, writes: "I am now an associate with the Demery Seed Capital Fund. This is a start-up seed fund that was formed as a result of a state-sponsored program to revitalize the state's economy. I am also teaching part-time at local colleges in the areas of management and computer science."

Phee Boon Kang, S.M.'75, was transferred to

Tokyo in January 1988 by Citicorp to be the business manager for the Japan Retail Bank. . . . Pam (Stone) Ryan, S.M.'86, reports her marriage on May 1, 1988 to Michael Ryan of Boston. Pam works in the Boston office of Goldman Sachs & Co., Michael with Ryan Elliott & Co., Inc. . Among principal speakers at the Institute of Management Sciences' 8th international conference on decision support systems in Boston in June: Randall Davis, associate professor of management science at M.I.T., John F. Rockart, Ph.D.'68, director of the Center for Information Systems Research in the Sloan School, and Peter Keen, former member of the M.I.T. faculty who is now executive director of the International Center for Information Technologies. . . . To Professor Glen L. Urban of M.I.T. and Gerald M. Katz, S.M.'72, senior vice-president, Information Resources, Inc., the 1988 O'Dell Award for the best publication in the Journal of Marketing Research.

Former students of both will rejoice in the news that Abraham J. Siegel, former dean of the school at M.I.T., is now the Howard W. Johnson Professor of Management. The professorship to honor Johnson was announced at ceremonies when the Athletics Center was dedicated in his name (see July, page MIT 4); Johnson had been dean of the school for 7 years when he was named president of M.I.T. in 1966. Siegel came to M.I.T. in 1954, three years after completing his doctorate at the University of California, Berkeley; he is a specialist in labor relations and collective . "Strategic Management of Techbargaining. nology and Information Technology" was the subject of a day-long workshop conducted in Washington, D.C., in April by Professors Arnoldo C. Hax and N. Venkatraman; their audience consisted of members attending the 25th joint national meeting of the Institute of Management Sciences and Operations Research Society of America. . . . A signal honor to a member of this year's senior class at the Sloan School: Sarbani Bublu Thakur, '88, has been chosen a Mellon Fellow in the Humanities. After a year in Germany, Thakur will use her fellowship to study feminist poets and other issues of comparative literature at the University of Toronto. . . . Two promotions are effective on the Sloan School faculty this summer: Stuart E. Madnick, Ph.D.'72, is now professor of management science, and Paul M. Healy, assistant professor since 1983, is now associate professor. Madnick has M.I.T. degrees in electrical engineering, computer science, and management; his principal field is management information systems, and he is a founding member of the M.I.T. Center for Information Systems Research. Healy, a native of New Zealand with advanced degrees from the University of Rochester, specializes in accounting.

Sloan Fellows

John P. Eberhard, S.M.'59, was among principal speakers at the 1988 national convention of the American Institute of Architects in New York; his topic: emerging technologies for cities of the 21st century. Eberhard is executive director of the National Academy of Sciences' Building Research Advisory Board.

Barbara Rust Baksh, S.M.'79, formerly assistant to the president of Santa Fe Railway at Chicago, has been appointed assistant vice-president—purchases and materials at Topeka, Kans. She joined Santa Fe as an environmental analyst in 1972. . . . Margery L. Pruessner, S.M.'87, writes: "Life in Boulder is fabulous! Cycling, biking, and skiing are the main activities, with IBM squeezed in to add that conservative perspective. Right now I am managing the Competitive Evaluation Laboratory for high-end printers."

Joseph A. Merrigan, S.M.74, a 22-year employee of Eastman Kodak, passed away in Webster, N.Y., on March 20, 1988. Merrigan had been active in the Society of Sloan Fellows and in Webster was a volunteer with R.P.Y.O. and a member of St. Paul's Church.

How Well Will It Fly? No One Knows The Answer

ow far will a plane fly, or how fast, or how high, are easy to know and even to forecast. In contrast, how well it will fly-how pilots will like it—is still hard to quantify, even harder to predict . . . and an "unsatisfactory" state of affairs, William H. Phillips, '38, told colleagues in his 1988 Hugh L. Dryden Lecture to the American Institute of Aeronautics and Astronautics early this year.

Continued research on flying qualities is essential "to maintain the superiority of future American airplanes," said Phillips, who is a distinguished research associate at NASA's Langley Research Center,

Hampton, Va.

The problem is twofold. "Flying qualities depend strongly on the involvement of the human pilot, whose behavior is variable and imperfectly understood," said Phillips. And the research tools needed to work on the problem-simulators, computers, and specially equipped aircraftare expensive to build and operate.

Though the dynamic stability of airplanes was the subject of a report as early as 1904, the entire period from the Wright Brothers' flight until 1935 is "characterized by lack of understanding of the relation between stability theory and flying quali-

ties," said Phillips.

Only in the late 1930s, when engineers began to recognize discrepancies between predicted and actual aircraft stability, were flying qualities made explicit in the specifications for a new airplane—the Douglas DC-4. In the 1940s came a set of requirements for satisfactory flyability that formed the basis for military specifications still used today. Since then, the advent of computer-based automatic control systems has promoted significant additional

But even now predicting its flying qualities before a new plane is built remains an elusive goal, said Phillips. Simulators now commonly used to design controls systems are helpful, but simulators still present problems. The high sensitivity of humans—for example, a pilot can sense a change in acceleration of two-thousandths the force of gravity—has to be matched by the simulator. Even the space shuttle orbiter provides an example of these problems: its landing characteristics remain "undesirable," said Phillips, and a "large amount" of pilot training is required.

Program for Senior Executives

Leon K. Kirchmayer, '75, recently retired from General Electric Co., was honored in Boston this spring with the Lamme Medal of the Institute of Electrical and Electronics Engineers. Kirchmayer was cited for "pioneering work in the operation and planning of electric utility systems." And James F. Roth, '73, chief scientist and corporate research director for Air Products and Chemicals, Inc., Allentown, Penn., received the Society of Chemical Industry's (American Section) 1988 Perkin Medal. Roth was cited for his "technical accomplishments and leadership in the field of catalysis and chemical process development."

AERONAUTICS AND **ASTRONAUTICS**

Sensor fusion," the technology of combining data from several sensors to yield more complete information about a process or situation, was the subject of Mark A. Gerber, S.M.'73, for the Boston Section of the Institute of Electrical and Electronics Engineers late last spring. Gerber, formerly with Draper Laboratory, Cambridge, is now a program manager at Alphatech, Inc., Burlington, Mass., responsible for two surveillance and tracking

Karen L. Fulcher, S.M.'86, writes from Malden, Mass.: "I'm working as a research scientist at Nichols Research Corp. (still!), developing computer codes to model exoatmospheric and reentry heating of reentry vehicles and delving into modeling of wake and plume fluid dynamics." . . . Allan Boardman, '55, of Woodland Hills, Calif., has been named group vice-president-administration, at the Aerospace Corp., El Segundo, Calif. Boardman joined the Corporation in 1962 and most recently served as vice-president-advanced systems operations, Development Group. . . . To David Shpilberg, Ph.D.'76, partner of Coopers & Lybrand, second place in the ACME (Association of Management Consulting Firms) 1987 Awards for Literary Excellence. Shpilberg was cited for his article "One Giant Step for Insurers" published in Best's Review, May 1986.

Rod Jacobs, S.M.'63, has been promoted from senior vice-president to executive vice-president of Wells Fargo Bank, San Francisco. Jacobs, who studied for a Ph.D. in economics at Stanford (1976), joined the Bank in 1979 as a financial analyst in management sciences, was named vicepresident in 1981 and senior vice-president in 1984. . . . Col. Terry R. Jorris, S.M.'63, USAF, writes from Huntington Beach, Calif.: "I'm at Los Angeles Air Force Base working on 'star wars' systems. John Clayton Jones, S.M.'63, is here too, working on one of the satellite programs." . . . Sam W. Thurman, S.M.'85, reports his marriage on October 4, 1987, to Lisa G. Nolan, and they are now in Pasadena, where Thurman is a staff engineer at the Jet Propulsion Laboratory in the spacecraft navigation systems area. . . . Nithiam T. Sivaneri, S.M. 78, reports from Morgantown, W.Va., that he is currently associate professor in the Department of Mechanical and Aerospace Engineering at West Virginia University, conducting research in the areas of helicopters, FEM, BEM, and fracture mechanics

Score a big win for Stephen L. Finberg, '77, of the Draper Laboratory staff. Finberg has worked as instrumentation expert and team photographer on all of the human-powered aircraft built at M.I.T. since he was a student, and Daedalus was no exception. Aboard a helicopter following the flight from Crete to Santorini (see page MIT 17), Finberg captured the image that Sports Illustrated chose for its frontispiece for "Winging Into History." . . Lena Valavani, who came to M.I.T. as a research associate after graduate study at Yale, and Daniel E. Hastings, Ph.D.'80, formerly at Oak Ridge National Laboratory, have been promoted to associate professors. Valavani's teaching and research are in control theory and applications, and Hastings has worked on spacecraft-environment interactions

and rocket propulsion.

Sheila E. Widnall, Sc.D,'64, Abby Rockefeller Mauze Professor at M.I.T., continues to make news. She is one of 19 leading experts chosen to staff a new Carnegie Commission on Science, Technology, and Government; its task: to assess how scientific and technical knowledge is incorporated into policymaking by the United States and the 50 state governments. Other members of the commission include M.I.T. economist Robert M. Solow; H. Guyford Stever, former dean of engineering at M.I.T. who is now foreign secretary of the National Academy of Engineering; and President Emeritus Jerome B. Wiesner. Widnall has just completed her service on the National Academy of Engineering's Committee on Technology Issues that Impact International Competitiveness, and last spring was honored with membership in the American Academy of Arts and Sciences. Professor Holt Ashley, Sc.D.'51, of Stanford University has been re-elected to a two-year term on the council of the National Academy of En-

XVII POLITICAL SCIENCE

Matthew Bunn, S.M.'85, who was the author of "The Next Nuclear Offensive" in the January 1988 issue of this magazine (pages 28-37), concludes in Arms Control Today for April 1988 that thenplanned tests of the SDI system would "violate a reasonable reading of the ABM treaty." But the Defense Department, he says, "seems bent on stretching the ambiguities [of the treaty] to the limit and beyond." Bunn is currently a senior analyst at the Arms Control Association, Washing-

Thomas G. Tate, S.M.'77, reports from University Park, Md., that he is developing interactive video programs for use in training farmers and ranchers. Initial applications are in farm financial management, pest management, and horticulture. He expects future applications will include radon mitigation and water quality and rural de-

The Swedish Council for Research in the Humanities and Social Sciences has tapped Professor Hayward R. Alker, Jr., of M.I.T. to be the first recipient of its Olaf Palme Professorship. Alker will spend the first six months of 1989 lecturing at Upsala and Stockholm Universities. . . . His book, The Business of the Japanese State: Energy Markets in Comparative and Historical Perspective, brought Professor Richard J. Samuels, Ph.D.'80, of M.I.T. the 1987 Masayoshi Ohira Memorial Prize. Awarded by the Ohira Memorial Foundation, the prize recognizes outstanding research on the Asia-Pacific

Louis Menand III retired from his post as senior lecturer in the department at M.I.T. at the end of June; he will continue part-time teaching. As the year ended he was honored with the 1988 Everett Moore Baker Award for Excellence in Undergraduate Teaching. . . . Richard F. Kazis, a graduate student at M.I.T., was honored this spring with a \$12,500 Dissertation-Year Fellowship from the Spencer Foundation; the funds will support the final year of writing Kazis' doctoral dissertation, the proposed title of which is "Industrial Structure and Mass Education in the Post-War Period."

XVIII MATHEMATICS

To Joseph J. Kohn, '53, professor of mathematics at Princeton, late last spring the honor of membership in the National Academy of Sciences And Professor Richard P. Stanley of M.I.T. was elected at about the same time to the American Academy of Arts and Sciences

Elliott H. Lieb, '53, who took his undergraduate degree in physics and returned to teach mathematics at M.I.T. from 1968 to 1975, has received the George David Birkoff Prize. Lieb, who is now

professor of mathematics at Princeton, was cited for "his profound analysis of problems arising in mathematical physics." The prize is awarded every five years by a joint committee of AMS and SIAM. . . Professor Victor W. Guillemin of M.I.T. will use a 1988-89 Guggenheim Fellowship to further his research in the theory of group representations and in the mathematics of solid-state physics.

Four members of the M.I.T. community have been tapped for the MS2000 oversight committee; the director of the project, the full title of which is Mathematical Sciences in the Year 2000: Assessment for Renewal in U.S. Colleges and Universities, will report to the committee. The four are William Browder, '54, professor of mathematics at Princeton who is president-elect of the American Mathematical Society; John M. Deutch, '61, provost of M.I.T.; Ramesh A. Gangolli, Ph.D.'61, professor of mathematics at the University of Washington; and Lynn A. Steen, Ph.D.'65, professor of mathematics at St. Olaf College, Northfield, Minn.

David Jerison, who joined the M.I.T. faculty in 1981, has been promoted to the rank of professor; he will be undergraduate chairman of the department for the year starting this fall. Jerison's work concerns Fourier analysis and partial differential equations.

Felix E. Browder, '46, who is now professor of mathematics and vice-president for research at Rutgers, was moderator of a symposium on Mathematics in the Sciences at the National Academy of Sciences late last'spring,

Five members of the M.I.T. community have received two-year post-doctoral fellowships in the mathematical sciences from the National Science Foundation: Bennett Chow and Richard Montgomery, instructors in the department at M.I.T.; Susan E. Landau, Ph.D'83, a member of the Wesleyan faculty; Robin A. Pemantle, Ph.D'88; and John R. Stembridge, Ph.D'85, of the University of California at Los Angeles.

Frederic V. Bien, Ph.D.'86, assistant professor of mathematics at Princeton University, is currently on leave at the Mathematical Sciences Research Institute, Berkeley, Calif. Bien has left behind for the year a successful jazz ensemble called "Night Moods," in which he is associated with Paul Mansky, '86 (VIII), and Mitchell J. Rothstein, '77, based in Princeton. "Joined by two seniors from Princeton, we have toured New Jersey and Manhattan, playing various jazz compositions of our own and original arrangements of standard tunes. We have had a lot of fun and it is not over . . . maybe someday we'll come to play Boston for M.I.T.," says Bien.

Frank Morgan, '74, is the author of Geometric Measure Theory (Academic Press, 1988), a text developed from the one-semester course for graduate students that he taught, at M.I.T. before moving to Williams College in 1986; the illustrations are by James F. Bredt, '82.

XXI HUMANITIES

Louis L. Bucciarelli, Ph.D.'66, associate professor of engineering and technology studies at M.I.T., is the author of a chapter evaluating the process of engineering design in Making Time: Ethnographies of High-Technology Organizations (Temple University Press, 1988). The editor, Frank A. Dubinskas, teaches organization studies at Boston College. Sarah J. Deutsch, assistant professor of history at M.I.T., will spend the coming academic year at the National Humanities Center under its fellowship program; she'll be studying the history of women in Boston between 1870 and 1950.

Three promotions are effective this summer:

Peter S. Donaldson is now professor of literature,
Theoharis C. Theoharis is associate professor of
literature, and Michael E. McGerr is associate
professor of history. Donaldson, at M.I.T. since
1973, has pursued a double career in literary and
historical studies specializing in the history of
Machiavelli's thought. A specialist in the history of

dramatic literature, Theoharis came to M.I.T. in 1984; McGerr, whose field is American political history, came in the same year. . . . Two members of the department at M.I.T. have received Guggenheim Fellowships for 1988-89: Jeanne S. Bamberger, associate professor of music, will continue her research on the development of musical intelligence, and Pauline Maier, professor of history, on American social development prior to the Civil War.

XXII NUCLEAR ENGINEERING

Eric Sasson, S.M.'57, reports: "I work in Paris for Air Products & Chemicals. It is a special career development program in which I have to do three missions of eight months each, in technical, marketing, and finance, before choosing a definite job. My first mission is to argue with the French authorities about liquid hydrogen." . . Frederick A. Kautz II, Nu.E.'83, is currently a staff member of the Aerospace Engineering Group at M.I.T.'s Lincoln Laboratory.

XXIV LINGUISTICS AND PHILOSOPHY

Institute Professor Morris Halle, professor of linguistics, was honored late last spring by election to the National Academy of Sciences. . . . Richard K. Larson and Donca Steriade, Ph.D'82, are now associate professors at M.I.T. Larson, a postdoc at M.I.T. in 1983-84 and a member of the faculty beginning in 1985, specializes in semantics; Steriade, whose appointment carries tenure, specializes in phonology, the science of speech sounds.

TECHNOLOGY AND POLICY PROGRAM

Stuart Batterman, S.M.'81, and wife Gloria Mason announced the birth of a son, Joel Mason Batterman, on March 19. . . . Daniel Jones, S.M.'81, is being transferred to the Mitre site in Seoul to assist with the evaluation of bids and procurements of a command and control system for the Army. . . . Louisa Koch, S.M.'88, has been selected as

... Louisa Koch, S.M.'88, has been selected as a presidential management intern.—Richard de Neufville, Chairman, M.I.T., Room 1-138, Cambridge, MA 02139

de Neufville's modesty seems to the editors excessive. He fails to report a signal honor to the Technology and Policy Program at the 1988 Honors Convocation: the Itwin W. Sizer Award to recognize its "innovation and improvement to M.I.T. education."—Ed.

THIS SPACE AVAILABLE

Present your message here to an audience in excess of 40,000 M.I.T. alumni.

For additional information, contact:

Technology Review Advertising Department (617) 253-8290

Technology Marketing Group Inc.

Marketing Consultants Specializing in Engineered Products and Materials

Our clients use us to: Find Growth Opportunities Plan New Products and Markets Reduce Selling Costs

Solve Marketing
Problems
Profitability
Develop New Sales
Channels
Improve Their
Marketing
Effectiveness

Leslie C. Hruby, S.M. '73, Sloan School F. Michael Hruby

77 Great Road Suite 202 Acton, MA 01720 (617) 263-0648

Haley & Aldrich, Inc.

Consulting Geotechnical Engineers, Geologists and Hydrogeologists

Soil and Rock
Mechanics
Foundation
Engineering Geology
Hydrogeology
Engineering
Geophysics
Earthquake
Engineering
Groundwater Supply
Investigations
Oil and Hazardous
Waste Site
Evaluations
Remedial Action
Design

Harl P. Aldrich '47 Martin C. Murphy '51 Edward B. Kinner '67 Douglas G. Gifford '71 Joseph J. Rixner '68 John P. Dugan '68 Kenneth L. Recker '73 Mark X. Haley '75 Robin B. Dill '77 Andrew F. McKown '78 Robert P. Rein '79 Keith E. Johnson '80 Deidre A. O'Neill '81 John A. Consla '82 Chris M. Erikson '85

58 Charles Street Cambridge, MA 02141 (617) 494-1606

George A. Roman & Associates Inc.

Architectural Planning Interior Design

Institutional
Commercial
Industrial
Residential
Site Evaluation
Land Use Planning
Master Planning
Programming
Interior Space
Planning
Colleges
Hospitals
Medical Buildings
Office Buildings
Apartments
Condominiums

George A. Roman, A.I.A. '65

Donald W. Mills, '84

One Gateway Center Newton, MA 02158 (617) 332-5427

Storch Engineers

Engineers Architects Surveyors Planners Geologists Soil Scientists Muncipal Services Landscape Architects Environmental Consultants

Florham Park, NJ 201-822-2600

Robbinsville, NJ 609-259-0640

Manchester, NH 603-623-5544

Wethersfield, CT 203-529-7727 New York, NY 212-371-4675

Jericho, NY 516-338-4500

Boston, MA 617-783-0404

Providence, RI 401-751-2235

Washington, DC 202-785-8433

Paul E. Dutelle & Company Inc.

Roofers and Metal Craftsmen

P.O. Box 96 Newtonville, MA 02160

Weingarten, Schurgin, Gagnebin & Hayes

Intellectual Property Law, including Patent, Trademark, Copyright, Unfair Competition, Computer and High Technology Law and Licensing. Litigation in all courts.

Ten Post Office Square Boston, MA 02109 (617) 542-2290 Stanley M. Schurgin Charles L. Gagnebin III,

S.M.'66 Paul J. Hayes Stephen G. Matzuk Albert Peter Durigon Victor B. Lebovici William F. Gray Steven M. Bauer, '79, S.M.'80

S.M. 80
Terrance J. Radke
Dean Graham Bostock
Euguene A. Feher

Of Counsel Alfred R. Johnson, '35 Joseph Zallen, '39

Deceased

The following deaths have been reported to the Alumni Association since the *Review's* last deadline:

Franklin L. Myrick, '15; March 20, 1987; Hamburg, Penn.

Fred J. Vogel, '15; March 10, 1988; Bradenton, Fla.

John G. Fairfield, '16; October 11, 1987; Troy, N.Y.

Earle F. Pearson, '16; October 29, 1988; Delray Beach, Fla.

Charles S. Reed, '16; April 7, 1988; Silver Spring, Md.

Samuel H. Creighton, Jr., '17; August 7, 1987; Clearwater, Fla.

Robert Gannett, '17; November 30, 1987; Bethlehem, Penn.

Mrs. Harry U. Camp, '18; 1988; Brewster, Mass. Edward W. Gore, '18; March 10, 1987; Amston, Conn.

George R. Bond, Jr., '19; April 8, 1988; North Reading, Mass.

Royden L. Burbank, '19; April 9, 1988; Belmont, Mass.

William C. Forbes, '20; February 14, 1988; New Bedford, Mass.

Eugene W. Sloan, '20; February 11, 1988; Salt Lake City, Utah.

Harold O. Berry, '22; April 16, 1988; Wakefield, Mass.

Louis H. Hobbs, '22; May 26, 1988; Newport, R.I.

Robert W. LeMare, '22; January 13, 1988; Charleston, S.C.

Milton M. Manshel, '22; December 11, 1987; West Palm Beach, Fla.

Robert P. Ramsey, '22; July 19, 1982; Defiance, Ohio.

George M. Tapley, '24; April 16, 1987; Delray Beach, Fla.

James C. Evans, Sr., '25; April 14, 1988; Washington, D.C.

Lloyd W. Irving, '25; April 4, 1988.

William F. Baker, '26; June 14, 1984; Scottsdale, Ariz.

A. Donald Green, '26; April 26, 1988; Mountainside, N.J.

Ole M. Hovgaard, '26; August 31, 1982; Brunswick, Maine.

Howard Humphrey, '26; March 28, 1988; Wilmington, Del.

Lewis C. Hutchison, '26; 1986; Temple, Tex. Joseph L. Brady, '27; January 19, 1988; Southbury, Conn.

Laurence B. Cheney, '27; March 25, 1988; Green-

wich, Conn.

Eugene N. Geisel, '27; December 7, 1987; Welles-

ley, Mass. Frederick S. Lutz, '27; March 13, 1988; Orange,

Frederick S. Lutz, '27; March 13, 1988; Orange Conn.

Richard N. Palmer, '28; May 16, 1988; Wolfeboro, N.H.

Hugh B. Spalding, '28; March 25, 1988; London, England.

Robert W. Reynolds, '30; April 30, 1988; Centerville, Mass.

Allen G. Shepherd, Jr., '30; April 10, 1988; Woonsocket, R.I.

William J. Hubbard, '31; October 28, 1987; Herkimer, N.Y.

Robert L. Parker, '31; April 23, 1988; North Reading, Mass.

John Slavin, '31; April 18, 1988; Wellesley, Mass.

Gordon A. Speedie, '31; February 17, 1988; Danvers, Mass.

Sidney E. Caldwell, '32; February 14, 1988; Portland, Ore.

John A. Finnerty, '32; May 10, 1988; Wellesley, Mass.

Herbert F. Ross, '32; April 20, 1988; Naples, Fla. Keith Smith, Jr., '32; February 7, 1988; Green River, Wyo.

Frank J. Lopker, '33; April 7, 1988; Downey, Calif. Thomas L. Apjohn, '34; December 27, 1987; Westport, Conn.

Frederick B. Parks, '34; November 10, 1987; Chester, NS, Canada.

Louis B.C. Fong, '35; February 11, 1988; Arlington, Va.

Milton E. Nelson, '35; April 27, 1988; Barrington, R I

Herbert S. Potter, '36; July 15, 1987; Reading, Penn.

Farmer L. Current, '37; April 2, 1988; Dunedin, Fla.

Maurice J. Perouse, '37; September 18, 1985; Paris, France. Edwin L. Howard, '38; March 19, 1988; Winters,

Calif.
Arthur L. Livingston, '38; May 24, 1987; Miami,

Fla. Charles M. Magnuson, '39; November 2, 1987;

Escondido, Calif.

Marshall A. Pease, '40; February 29, 1988; Kensington, Conn.

James C. Broderick, '43; January 27, 1988; Ellicott City, Md.

Robert C. Habich, '45; February 21, 1988; Rhein-

Robert C. Habich, '45; February 21, 1988; Rheinfelden, Switzerland.

Robert L. Townsend, '43; December 19, 1987; Falls Church, Va.

John B. Breymann III, '44; April 19, 1988; Malden, Mass.

George V. Hawkins, '48; March 18, 1988; Chappaqua, N.Y.
Edward F. Koetsch, Jr., '48; March 11, 1988; Long-

meadow, Mass.

Richard W. Souza, '48; April 15, 1988; Lexington, Mass.

Wayne N. Fitzpatrick, '49; December 4, 1987; Severna Park, Md.

Edward S. Rogers II, '49; March 8, 1988; Burlington, Ont., Canada.

William A. Krampert, '51; May 9, 1988; Green Valley, Ariz.

Charles M. Apt, '52; April 8, 1988; Belmont, Mass.

Robert J. Browne, '53; January 30, 1988; Dedham, Mass.

Robert W. Dickinson, '53; September 8, 1985; Altadena, Calif.

Leon A. Sweet, '57; March 20, 1988; Grosse Pointe Park, Mich.

Ralph M. Gifford, '58; April 4, 1988; Noank, Conn.

Conn. Melvin L. Hurni, '58; April 19, 1986; Henderson-

ville, N.C. Joaquin M. Borrero, '59; June 17, 1987; Tequesta,

Fla.

Alan J. Buschbaum, '61; April 10, 1987; New

York, N.Y.

Rajinder N. Chanda, '64; May 17, 1986; Chapel

Hill, N.C. M(arcellus) Jack Anderson, Jr., '69; April 24, 1988; Austin, Tex.

Frederick N. Linderman, '74; October 30, 1987; Ischua, N.Y.

Charles R. Souter, '83; May 22, 1988; Boston, Mass.

ALLAN J. GOTTLIEB, '67

439,792 Ways to Seat Ten Men

ary Lindenberg wrote (on 29 March) that April 4 would be the 70th birthday of her husband, Martin, and in celebration she sent in a solution to APR 4. She also mentioned that the published solution to N/D 3 gives a hint of a possible attack on Fermat's Last Theorem.

In the December issue, Jim Landau conjectured that the radius of an n-dimensional regular tetrahedron is 1/n the radius of the circumscribing sphere. Dennis White reports validating the conjecture

Phelps Meaker reports on several very simple looking rational functions for which the solution is x = .61803398875

Finally, William Eaton directs us to an interesting article on string figures—that is, taking a loop of string, placing your hands inside, and manipulating the loop to form interesting patterns. The article appeared in the April 25th issue of *Insight*.

Problems

A/S 1. David Evans has placed white knights on a1, b1, and c1 and black knights on a4, b4, and c4. He wants you to find the minimum number of moves needed to interchange the positions of the knights disregarding possible captures. Only the first four ranks and the first three files are to be used.

A/S 2. Matthew Fountain reports that a computer expert wanted to find the average length obtained for the largest part of a line of unit length when the line is randomly divided into four parts. The expert wrote a program that summed four random numbers between zero and one and divided the largest of these four random numbers by their sum. Is the average result he obtained from his program the length he sought?

A/S 3. Scott Berkenblit poses a challenge



SEND PROBLEMS, SOLU-TIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MER-CER ST., NEW YORK, N.Y. 10012. he saw in a Russian book of math problems:

Find the exact value of the product $tan(80) \times tan(40) \times tan(20)$, where all angles are expressed in degrees.

A/S 4. Ken Rosato's rocket accelerates from 0 velocity to C (the velocity of light, 186,000 miles per second) with a constant acceleration (relative to a stationary observer) of 1g = 32 feet per second². It carries a clock synchronized to an identical clock at rest with the stationary observer. When the velocity of the rocket reaches that of light, how far behind the stationary clock will the clock on the rocket be?

A/S 5. Our last regular problem comes from the February 1986 issue of *IEEE Potentials*, where it was attributed to Bruce Layman:

An IEEE student member entered the north end of a tunnel of length L. After walking the distance L/4 into the tunnel, he noticed a car approaching the north entrance at 40 miles per hour. The student knew his own speed and calculated that no matter which end of the tunnel he ran to, he would arrive there at the same time as the car. What is his top speed? Hint: he might do better as a professional athlete than as an engineer.

Speed Department

SD 1. Jim Landau wants to know the value of

|12 8 |3 2 |6 8 |3 4

SD 2. Alex Okun recalls when Archimedes was working on a math problem in the sand and a passerby asked him, "How long until I get to Syracuse?" Archimedes said only, "Go!" The passerby started walking on and Archimedes called after him, "About two hours." Why?

Solutions

APR 1. Black moves first, and White and Black are to cooperate so that Black is mated on White's fourth move.

Dike, Bronstein, Roberts, Cushman & Pfund

Patent, Trademark, Copyright, Trade Secret, Antitrust and Unfair Competition Law

130 Water Street Boston, MA 02109 (617) 523-3400

Route 128 Office: Executive House 2345 Washington Street Newton, MA 02162 Sewell P. Bronstein Robert T. Gammons, '33 Charles E. Pfund Donald Brown Robert L. Goldberg Robert F. O'Connell, '53 David G. Conlin George W. Neuner, '66 Philip G. Koenig Robert M. Asher, '78 Gregory D. Williams Ernest V. Linek

Steinbrecher Corp.

Contract research and development in radio frequency, microwave and millimeter wave engineering and related areas.

RF and Microwave Systems Design Industrial Applications of Microwave Power Precision Instrumentation Analog and Digital Electronics Manufacturing facilities available

185 New Boston Street Woburn, MA 01801 Telex 948-600 (617) 935-8460

H.H. Hawkins & Sons Company

Building contractors

Steven H. Hawkins, '57

20 Pond Park Road Hingham, MA 02043 (617) 749-6011 (617) 749-6012

Debes

Health Care Consultants

Design, Construction, Management

Subsidiaries Charles N. Debes & Assoc. Inc. Alma Nelson Manor Inc. Park Strathmoor Corporation **Rockford Convalescent** Center Inc. Chambro Corporation

Charles N. Debes '35 5668 Strathmore Drive Rockford, IL 61107

RELA, Inc.

Contract design, research. development and manufacturing of electronic-based products and systems

Digital hardware design and development

Analog hardware design and development

Software design and development **Product specifications**

Feasibility studies research Prototype

development Production engineering

Test design

Pre-production manufacturing Systems integration 6175 Longbow Drive Boulder, CO 80301 (303) 530-2626

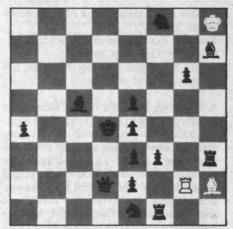
Rod Campbell '81 Robert H. Noble '76 Don R. Widrig '65



Builders for industry. institutions, hospitals manufacturing plants, government and developers of high technology facilities for over 35 years

Edward R. Marden '41 Douglas R. Marden '82

280 Lincoln Street Boston, MA 02134 (617) 782-3743



Karim Roshd sent us the following solution:

	White	Black
1.		Q-d3
2.	R-f2	PxR
3.	B-g3	K-e3
4.	B-h4	B-d4
5.	B-g5	mate

Also solved by Robert Bart (who feels the problem should be called "one step at a time"), Matthew Fountain, Charles Larson, and Richard Hess.

APR 2. Find two positive integers differing by five such that the sum of their squares is a perfect cube, and show that the solution is unique.

Dennis White found that there are at least two solutions, so no uniqueness proof is possible. He

 $5^2 + 10^2 = 5^3$ and $47^2 + 52^2 = 17^3$

White also showed that the number being cubed must itself be a sum of two squares, but like everyone else was unable to show uniqueness.

Also solved by Richard Hess, James Walker, David Smith, Jonathan Aronson, Ken Rosato, Charles Larson, Matthew Fountain, Winslow Hartford, Frederick Furland, Dennis White, Matthew Fountain, Avi Ornstein, Ken Rosato, Norman Wickstrand, Robert Bart, Edward Dawson, Harry Zaremba, Charles Rivers, and George Adams.

APR 3. As with the standard Towers of Hanoi problem, there are three pegs; initially there are n rings on one of the pegs, graded in size from largest at the bottom to smallest on top. The problem is to find the minimum number of moves to transfer all of the rings to another peg, one at a time, never having a larger ring on top of a smaller one. The variation is that only clockwise moves are permitted. For example, if the pegs are labeled A,B,C, then the only moves permitted are A to B, B to C, and C to A. There are two cases of solution, one for moving all the rings to the nearest peg in the clock-

wise direction, and one for moving to the third peg. The following solution is from William Messner. Let f(n) be the number of moves to move a stack of n rings (an n-stack) one peg (all motions are clockwise), and let g(n) be the number of moves needed to move an n-stack two pegs. To move an n-stack one peg, one must first move an (n-1)-stack two pegs, then move the remaining ring one peg, and finally move the (n-1)-stack two pegs. Hence f(n) = 2g(n-1) + 1.

To move an n-stack two pegs, one must first move an (n-1)-stack two pegs and the remaining ring one peg. Next move the (n-1)-stack one peg, and the remaining ring one peg. Finally, the (n-1)-stack

moves two pegs. Hence g(n) = 2g(n-1) + f(n-1) + 2. Substituting for f(n-1) gives the nonhomogeneous second order linear finite difference equation g(n) = 2g(n-1) + 2g(n-2) + 3.

A particular solution is $g_p(n) =$ -1. The homogeneous solutions are found by assuming $g_h(n) = \lambda^n$,

which leads to $\lambda=1\mp\sqrt{3}$ and hence $g_4(n)=A(1+\sqrt{3})^n+B(1-\sqrt{3})^n$. Since g is the sum of the homogeneous and particular solutions, we

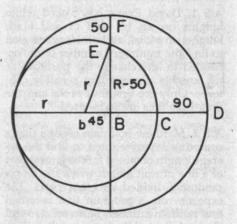
 $g(n) = A(1+\sqrt{3})^n + B(1-\sqrt{3})^n - 1.$

Plugging in g(0) = 0 and g(1) = 2 gives the values for A and B.

Also solved by Winslow Hartford, Scott Berkenblit, Dennis White, George Adams, Jonathan Aronson, Matthew Fountain, Richard Hess, Robert Bart, and the proposer, Peter Gottlieb.

APR 4. Two circles shown in the diagram touch at A. The larger circle has its center at B. The width of the crescent between points C and D is 90 mm. and between points E and F the distance is 50 mm. What are the diameters of the two circles?

Edgar Rose sent us the following solution: Let point b designate the center of the small circle, and R and r the radii of the large and small circles respectively. All dimensions will be in mm.



bEB forms a right triangle in which:

EB = R - 50 = r - 5 (since r = R - 45) Bb = 45

Therefore

 $r^{2} = (r \times 5)^{2} + (45)^{2}$ $r^{2} = r^{2} - 10r + 25 + 2025$

r = 205

Thus, the two diameters are 410 and 500 mm.

Also solved by David Smith, Frederick Furland, Harry Zaremba, Winslow Hartford, Kelly Woods, Norman Wickstrand, David Wagger, Howard Stern, Ken Rosato, Ray Ellis, Michael Riezenman, Greg Spradlin, Matt Stenzel, Jim Czajka, Norman Spencer, John Cushnie, David Margulies, Stephen Callaghan, David Deleeuw, George Parks, Harry Garber, Tomo and Shirley Hasegawa, Art Harris, Steven Feldman, L.J. Upton, William Messner, Robert Bart, Stephen Berkenblit, Jonathan Aronson, Matthew Fountain, Richard Hess, Dennis White, Mary Lindenberg, Phelps Meaker, George Adams, R.L. Loesch, Charles Rivers, H.J. de Garcia, R.L. Loesch, and an anonymous reader from Irving TX.

APR 5. Arrange the integers from 1 to 25 in a 5 x 5 grid so that each column and row sums to 65. Moreover, each of the 10 diagonals is to sum to 65. These 10 diagonals are formed by starting at each of the 5 elements in the first row and proceeding southwest and southeast, identifying the left and right edges of the grid. For example, one diagonal includes the elements located at (1,4), (2,3), (3,2), (4,1), (5,5).

The following solution is from Jonathan Aronson: Another way of looking at this problem is to use the numbers 0 to 24 and have all rows, columns, and diagonals sum to 60. One can view 0 to 24 as all the two-digit numbers base 5 and thus break up the original problem into two smaller problems, making magic squares for the ones and fives places. These are really the same problem since the latter can be obtained by multiplying each entry in the former by 5, which has the effect of adding a zero to each entry (base 5). Here is one solution obtained by placing 0 to 4 in the first row and then rotating:

0	1	2	3	4
3	4	0	1	2
1	2	3	4	0
4	0	1	2	3
2	3	4	0	1

As mentioned, multiplying by 5 gives the second square. Before adding the two squares, we rotate the second about its main diagonal (to prevent duplicate entries). Finally, add 1 to each entry so the numbers go from 1 to 25 as specified. This yields the final solution:

1	17	8	24	15
9	25	11	2	18
12	3	19	10	21
20	6	22	13	4
23	14	5	16	7

Also solved by L.J. Upton, Winslow Hartford, Harry Zaremba, Matthew Fountain, Richard Hess, Dennis White, and the proposer, Ronald Martin.

Better Late Than Never

1985 A/S 3. Dennis White agrees with the proposer that the four-port electronic device produces an arc of a circle, thus disagreing with the published solution. Mr. White's argument, which would be hard to typeset, is available from the editor.

1987 N/D 3. Karim Roshd enjoyed the solution.

N/D 4. Mark Lively noticed that it is not hard to transform the figure printed into Pascal's triangle, giving a simpler method for calculating the entries. Gordon Rice also found a simpler solution.

N/D 5. Mark Lively, Richard Hess, Gordon Rice, Jorgen Hormse, and Matthew Fountain have objected to the solution printed. (The published answer was $(n-1)^{(n-2)}$.) Mr. Lively writes:

The first factor anchored an arbitrary woman and randomly placed the other (n-1) women. As a minor point, isn't having someone to my right the same as having the same person to my left? Thus, shouldn't the first factor be (n-1)/2? The second factor allowed any man a choice of the (n-2) empty seats not next to his date. That selection determined the selection for every other man. The men sit in the same order as their dates but all rotated around the table by 3 seats, or by 5 seats, or by 7 seats, . . However, the selection process for the men need not be that rigid once we get past 4 couples. Assume 5 couples and that the women are seated. Refer to them as ABCDE in order around the table. Assuming the first position for men is between A and B and the last is between E and A, the men can sit

caeba	daebc	eabcd*
cdeab*	daecb	edabc
ceabd	deabc*	edacb
cebad	deacb	edbac
	debac	

The asterisks indicate the (n-2=3) combinations that are in the same order as the women but with the men rotated 3, 5, or 7 seats from their dates.

Once n women are seated, how many ways can n men be seated? n! But many of these ways are illegal in that a man sits next to his date. a can't sit on either side of A, which rules out 2(n-1)! combinations. Similarly for b, c, d, etc. Once a has been seated, many of the 2(n-1)! illegal ways for b have already been eliminated. If b is in chair AB and a is in chair XA, there are (n-2)! ways to arrange the other men. These combinations were eliminated in the placement of a. If b is in chair BC, a can be in XA or AB for additional double eliminations. Thus, once a has eliminated 2(n-1)! combinations, the number of combinations b can eliminate are 2(n-1)! - 3(n-2)!

Then the number of combinations c can eliminate

2(n-1)! - 7(n-2)! + 4(n-3)!

Then the number of combinations d can eliminate

2(n-1)! - 11(n-2)! + 16(n-3)! - 5(n-4)!

Due to space constraints, Lively's development of the coefficients of the factorials has been omitted but is available from the editor. The coefficients are the sums of the (2n-1) and (2n) terms. Once the 10 women are seated the 10 men may be seated 439,792 ways.

1988 FEB 1, FEB 2. Caroline Richardson, David Simen, and Jonathan Aronson have responded.

FEB 3. Jonathan Aronson has responded.

Proposers' Solutions to Speed Problems SD 1. Indeterminant.

SD 2. Archimedes needed to know how fast the passerby walked.

Goldberg-Zoino & Associates Inc.

Geohydrological Consultants

The GEO Building 320 Needham Street **Newton Upper** Falls, MA 02164 (617) 969-0050

Other Offices: Bridgeport, CT Vernon, CT Plymouth, MI Manchester, NH Buffalo, NY Providence, RI

D. T. Goldberg, '54 W. S. Zoino, '54 J. D. Guertin, Jr., 67 R. M. Simon, '72

A. E. Adenekan, '85 M. J. Barvenik, '76

D. M. Brown, '84 M. D. Bucknam, '81 N. A. Campagna, Jr., '67 F. W. Clark, '79

R. Doherty, '87 K. A. Fogarty, '81 W. E. Hadge, '79

C. A. Lindberg, '78 J. S. Munic, '85

J. D. Okun, '75 K. J. O'Reilly, '80

T. von Rosenvinge IV, '80 D. W. Wood, '76

lames Goldstein & **Partners**

Architects Engineers Planners

R&D **Facilities**

For High Technology Fields

Serving the Science Community Since 1953

Biotechnologies Chemical Engineering Computer Science **Medical Sciences** Microelectronics Solid State Physics **Telecommunications** Toxicology

S. James Goldstein, '46 Eliot W. Goldstein, '77

89 Millburn Avenue Millburn, NJ 07041 (201) 467-8840

Syska &

Engineers

Mechanical/Electrical/ Sanitary

11500 West Olympic Blvd. Los Angeles, CA

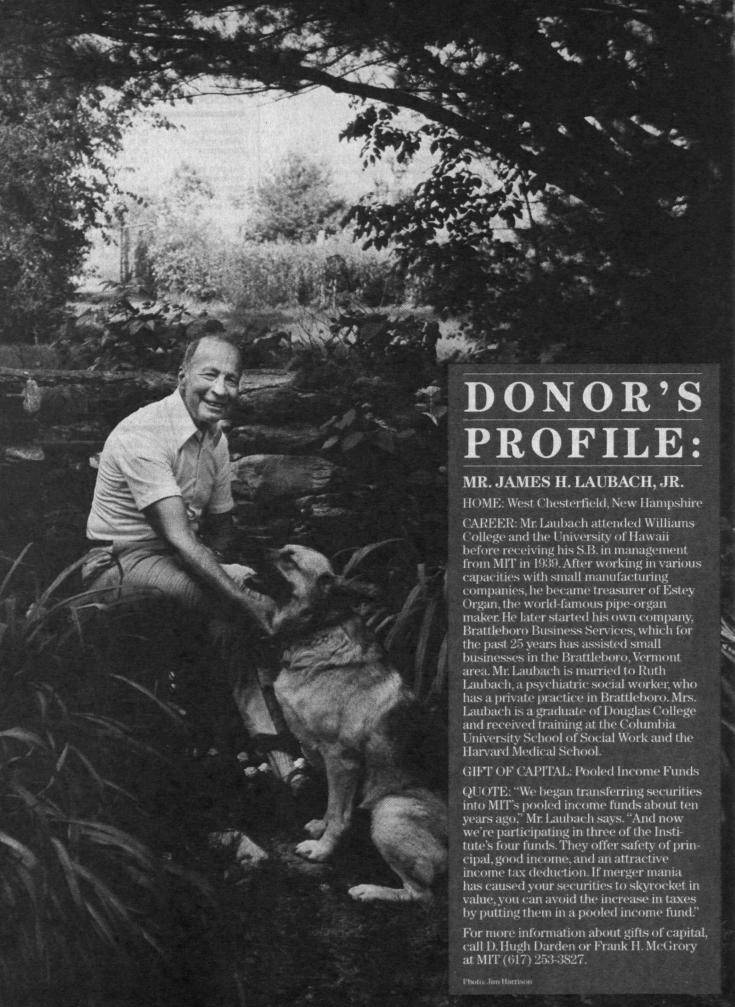
John F. Hennessy '51

11 West 42nd Street New York, N.Y. 10036

100 Mass. Ave. Cambridge, MA 02138

657 Mission St. San Francisco, CA 94105

90064



MOTHER JONES MAKES WAVES.

Our investigations have uncovered the dumping of hazardous products on foreign markets, a dangerous IUD, the deadly Pinto, Nestle's disastrous marketing of infant formula, and other scandals. MOTHER JONES gets results: legislation, recalls, and compensation for victims. We set a record for winning National Magazine Awards—three in our first four years of publishing.

(That's the Pulitzer Prize of the magazine industry.)

MOTHER JONES MAKES ENEMIES.

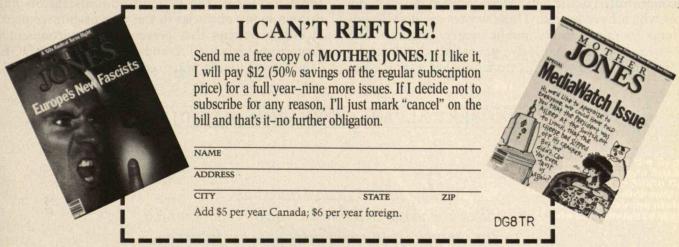
Some of the fattest cats in America have demanded everything from the revocation of our National Magazine Awards to denial of our mailing rights. We get under their skin—and they yell. We've been called "irresponsible, scabrous" (by an Agency for International Development official), a publisher of "lies, half-truths and distortions" (by a top Ford executive, about our article which made him recall two million Pintos), and "sleazy" (by Ronald Reagan's chief foreign policy advisor).

We've never been called "dull."

MOTHER JONES MAKES SENSE.

Whether our writers are taking on multinational corporations, the medical profession, or the CIA, you can expect MOTHER JONES to hit the target. Hard. Look at some recent stories: "Nerve Gas: The Poor Man's A-Bomb Makes a Comeback," on the new generation of nerve gases (and the aging, 400,000-ton arsenal of older gas the U.S. Army must dispose of); "Killers on the Right," a look at Europe's right-wing terrorists, whose attacks include the two most devastating acts of terror in postwar Europe; and "Terror on Sacred Ground," a report on the curious, and frightening, alliance between Christian and Jewish fundamentalists bent on bringing about the Armageddon. MOTHER JONES bring you up-to-the-minute reports on topics like: the plastic pistol General Electric is helping to develop (it will pass undetected through airport security systems); the continuing, but little-reported war in El Salvador and the new, more militant environmental groups that are raising the stakes in the battle to save the planet.

MOTHER JONES MAKES YOU AN OFFER.



OF THE ARMS RACE

RADIOACTIVE

Variety over \$24 billion in physical assets, an annual budget of about \$8 billion, and a land base larger than Delaware and Rhode Island combined, the U.S. government's program for producing nuclear weapons would rank toward the top of the Fortune 500. Like many private industries, this one has a major hazardous-waste problem. For the past four decades, a network of 280 facilities at some 20 weapons-making sites has produced massive quantities of highly radioactive waste. Because the Department of Energy runs these facilities in secret, with virtually no outside oversight from either Congress or environmental agencies, this dangerous material has been stored and buried in ways that threaten employees and the public.

Billions of gallons of radioactive wastes from making bomb-grade material have been dumped directly into soil and groundwater. Millions more gallons of concentrated waste have been stored in tanks, many of which have leaked. These wastes are now beginning to contaminate public water supplies. The wastes also form explosive gases that could rip the tanks open and spew the material over a large area,

creating a Chernobyl-scale accident.

The Department of Energy (DOE), which manages the weapons program, estimates that the bill for cleaning up this waste could total \$100 billion—far more than was spent to create fissionable materials in the first place, and much more than the cost of cleaning up the nation's privately owned Superfund sites. This price is forcing Congress to reconsider the long-term outlook for the nation's nuclear-weapons

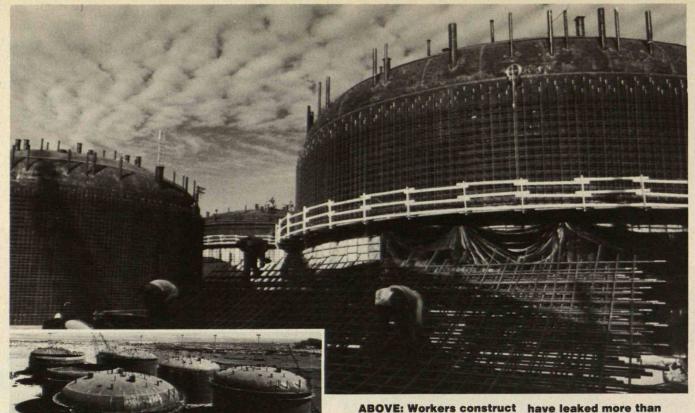
program.

DOE has long argued that the Atomic Energy Acts of 1946 and 1954, which gave it sweeping powers of self-regulation, take precedence over environmental statutes such as the Resource Conservation and Recovery Act and Superfund laws. In the last several years, Congress has enacted legislation specifically requiring DOE to meet standards set by these laws. But although the agency has agreed to comply in some instances, the Reagan administration has thrown many obstacles in the way of enforcement, including policies that prevent the Environmental Protection Agency (EPA) and states from suing DOE. Thus, many unsafe practices continue.

BY ROBERT ALVAREZ AND ARJUN MAKHIJANI

The military's vast quantities of radioactive waste will threaten nearby communities for centuries and could determine the future of the nation's weapons program.





ABOVE: Workers construct a steel mesh that will support concrete reinforcement for the high-level waste tanks at Hanford, Wash. Newer tanks are now built with double steel shells, but older tanks

have leaked more than 500,000 gallons of radioactive material. RIGHT: Weapons-making facilities containing over 2,000 dump sites for radioactive and hazardous waste dot the U.S. landscape.

States such as South Carolina, Ohio, and Washington—home of the major plants producing bombgrade materials—are trying to force DOE to comply with the law. These states are afraid that if nuclear-weapons production is cut back, they will have to clean up the waste, which is lethal in even the most minute quantities and will remain dangerous for thousands and even millions of years.

In response to public pressure, DOE has developed plans for cleaning up some severely contaminated sites. Yet these plans are so poorly thought out that they threaten to worsen the pollution instead of containing it. Indeed, a National Academy of Sciences panel recently concluded that DOE should drastically curtail its plans to store plutonium-contaminated soil in a New Mexico repository known as the Waste Isolation Pilot Project, or WIPP, until doubts about the site's safety can be answered.

ROBERT ALVAREZ is director of the nuclear project at the Environmental Policy Institute in Washington, D.C. ARJUN MAKHIJANI is director of energy programs at the Institute for Energy and Environmental Research in Takoma Park, Md. They are the authors of Deadly Crop in the Tank Farms, a 5-year study of the Department of Energy's management of high-level nuclear waste. They obtained over 50,000 pages of DOE documents for the study through the Freedom of Information Act.

Troubles at the Tank Farms

High-level military wastes result mainly from producing plutonium for nuclear weapons and reprocessing spent fuel from naval reactors. (High-level wastes are defined as those giving off .5 to 5 Btus of decay heat per hour per gallon.) These wastes contain not only an array of very concentrated, long-lived radioactive elements, including plutonium, but also substantial amounts of other hazardous materials such as mercury and solvents.

The wastes that pose the most serious immediate risk to workers and the public are liquids. These are largely produced at the Hanford site in Washington state, run by Westinghouse for DOE, and the Savannah River plant in South Carolina, run by Du Pont. Together the two facilities have generated nearly 100 million gallons of liquid high-level wastes.

Problems with handling these extremely radioactive substances stem from the origins of the nuclear-weapons program during World War II. Architects of the Manhattan Project devised the idea of storing the waste in tanks as an "interim emergency method" until long-term solutions could be found. Because stainless steel was then in short supply, of-



ficials decided to use carbon-steel tanks. But bomb wastes are acidic, which meant they had to be neutralized so they would not dissolve the carbon steel. The neutralization process—which involves adding lye and water to the wastes, and is still in use today turned out to cause major problems.

First, adding water increases the volume of wastes, making disposal more difficult. And adding lye creates chemical reactions that allow the radioactive elements to precipitate out as sludge. Some 90 percent of the radioactivity becomes concentrated at the bottom of the tanks, where heat builds up and causes them to crack. At least 500,000 gallons of highly radioactive liquids have already escaped from the Hanford tanks because of such corrosion cracking. And 149 tanks at Hanford are so compromised that the wastes cannot be removed without risking further leaks. In some cases salts created by the neutralization process are plugging the cracks. If the contents were removed, the tanks would break wide open.

Although the tank option was supposed to be temporary, managers of the weapons program continued to store high-level wastes in carbon tanks after the war. (This practice continues today.) Du Pont called this the "most economical" storage method one that would not interfere with the rapid buildup of the nation's nuclear arsenal during the 1950s and 1960s. No timetable was set for emptying the tanks and devising a secure long-term program for managing the waste.

When the tanks began to leak in the 1950s and waste continued to build up, contractors such as Du Pont realized they had to reduce the waste's volume and make its storage more secure. At Savannah River, managers decided to allow liquids fresh from the reprocessing plants to decay, and thus cool somewhat, for several months. This material was-and still is—then evaporated, which entails moving it to evaporators and then back to the original tanks. Thus "tank farms" have evolved with pumps, jets, and miles of pipe. However, much of this equipment has itself leaked and failed to work properly, and waste has spilled and contaminated workers as it has moved from tank to tank.

In response to early problems at Hanford, Du Pont installed concrete shells with partial steel linings around the tanks at Savannah River. Newer units have a full secondary steel liner. But even these "double-shell" tanks have had their share of major problems, since the concrete has not been an effective barrier to the hot wastes. By 1960, within five years of construction, 4 of the first 16 tanks at Savannah River had developed leaks in both the primary and



secondary shells. Workers also discovered severe rust pits, a third of the way through tank walls, on 14 newer units built during 1980 and 1981. Nevertheless, these units entered service. This latest problem casts doubt on the integrity of all the 228 tanks at Hanford and Savannah River.

Dumping into Soil and Groundwater

Another key waste-management philosophy from the 1950s and 60s—"dilution is the solution to pollution"—has also failed to withstand the test of time. DOE scientists have long maintained that low-level radioactive wastes from the weapons program could be safely discharged into the ground. They assumed that soil particles would trap the most dangerous materials and dilute them to negligible levels. Scientists also counted on the geology beneath the weapons sites to further dilute dangerous substances and prevent them from reaching public water supplies. This "buffer zone" concept required very large land bases-Hanford occupies some 600 square miles and Savannah River 300 square miles. The dilution hypothesis also convinced DOE and its predecessor, the Atomic Energy Commission (AEC), to regulate pollutants at the site boundaries rather than where they were discarded.

At Hanford, these concepts have led the agency to dump 200 billion gallons of radioactive waste into

shallow evaporation ponds, seepage basins, and burial pits—enough to create a lake the size of Manhattan 40 feet deep. Even now Savannah River discharges about 180,000 gallons of radioactive and hazardous wastes into seepage basins every day. And in the 1940s, Hanford deliberately piped 15 million gallons of high-level tank wastes containing over 10 pounds of plutonium into groundwater.

DOE has also buried dry plutonium-contaminated wastes in cardboard boxes, a practice that is supposed to end this year. Contractors at several sites only recently stopped rototilling radioactive and haz-

ardous wastes into the soil.

The dilution theory has further led the agency to release large amounts of radioactive materials to the air. During the 1940s, airborne discharges from Hanford's reprocessing facilities were enormous particularly of iodine-131. The Centers for Disease Control (CDC) recently concluded that residents near Hanford received higher thyroid doses of radioiodine than people living in the immediate vicinity of the Chernobyl reactor. Infants living in the Hanford area during the 1940s and 1950s may have received as much as 2,300 rems of radioactivity from cow's milk—far more than children living near the Nevada bomb tests during the 50s and 60s. According to the CDC, more than 30,000 children may have increased their chances of contracting thyroid cancer 5- to 15-fold.



LEFT: The Hanford N-reactor, one of the nation's oldest plutonium facilities, was recently placed on "cold standby" when DOE decided not to invest the huge sums needed to uprade its safety. AR LEFT: Employees at

the Fernald uranium-processing plant in Ohio remove clothing contaminated with uranium dust. An Oak Ridge task force reported that Fernald had released 374,000 pounds of this dust into the air and water.

Radioactive releases have decreased dramatically since DOE began adding air-filtration equipment to the plants in the 1960s. However, DOE's new models predicting the radiation doses from releases that still occur may be highly inaccurate. In a recent experiment, DOE, the air force, and the National Weather Service tracked the movement of radioactive plumes from Savannah River. According to William Lawless, the former DOE official who managed the study, "The plumes were about 10 times more radioactive in New Jersey than [the model] claimed they would be at the site boundary" in South Car-

Evidence of water and soil pollution also began contradicting DOE's own models soon after these practices began. For example, radioactivity has migrated through soil much more quickly than predicted, partly because the organic solvents speed its movement. Soil may also become saturated much faster than the models project. Experts at Savannah River had predicted that plutonium dumped in pits would take at least 1 million years to reach the water table. But plutonium at levels higher than those EPA allows was detected in on-site groundwater in less than 20 years. A 1986 report by the General Accounting Office found that 8 of 9 DOE weapons sites surveyed have "groundwater contaminated with radioactive and/or hazardous substances to high levels. . . . Six facilities have soil contamination

in unexpected areas, including offsite locations." An internal Du Pont study admits that severe contamination from decades of dumping "may extend well beyond the period which land control can be anticipated and indeed may exist for centuries or milennia."

The AEC called for an end to soil disposal in 1971, and set 1976 as the deadline for eliminating the practice. However, the agency reversed itself, and dumping continues today. DOE is supposed to be developing new standards for soil disposal that meet those set by states under the federal Resource Conservation and Recovery Act (RCRA). But the Reagan administration has prohibited EPA from ordering the agency to comply, and has refused to allow DOE to pay civil fines to states or to seek funds from Congress for out-of-court settlements. The Justice Department has also prohibited EPA and states from reviewing DOE's cleanup programs before they take effect. Thus, with little outside oversight, it's difficult to determine whether the agency is improving its record.

Earthquakes and Explosions

DOE's tank farms pose serious risks in addition to those from cracks and leaks. The radioactive waste interacts with water and chemicals to form hydrogen and organic vapors, which could explode. An exploding tank would send massive amounts of radioactive material spewing into the air and onto the ground. Using Du Pont's figures for such an accident. we estimate that residents living near Savannah River could contract as many as 20,000 additional cancers.

A massive explosion of radioactive wastes has already occurred in the Soviet Union. A 1957 accident in the Urals severely contaminated a large area and may have killed many people. The Soviet Union still denies that such an explosion took place.

The Savannah River plant faces an additional danger: that an earthquake could destroy its waste tanks. The largest and most destructive earthquake ever recorded in the eastern U.S.-measuring 8 on the Richter scale—occurred in 1886 near Charleston, S.C., only 90 miles from the Savannah River site. The quake caused tremors over a 2 millionsquare-mile area and damage as far away as Chicago. The U.S. Geological Survey and the Nuclear

Experts predicted that plutonium waste would not reach the water table for 1 million years, but it took only 20.

Regulatory Commission have both concluded that such a quake could occur again at or near the plant.

Savannah River's tanks have not been built to withstand severe quakes. Such an event could therefore release millions of gallons of radioactive waste to the area. Tens of thousands of excess cancers could result (not including immediate deaths among the thousands of workers on site), and cleanup could cost billions of dollars.

Even a smaller quake than that in 1886 could allow water in the severely contaminated shallow aquifers beneath Savannah River to enter the Tuscaloosa formation, a major regional acquifer. Du Pont claimed in a 1978 study that groundwater contamination from major tank ruptures would be "insignificant" because of the area's geology. Yet no one can be sure that the underlying geological structure will remain stable for thousands of years.

Even routine operations at Savannah River could change the area's geology. Du Pont now pumps out 3 billion gallons of water each year from the acquifer. According to University of Maryland geologist Yaron Sternberg, this could increase the "drawdown" of groundwater levels, and therefore the rate that contaminants migrate.

Employee Safety Suffers

DOE's lax standards in handling radioactive waste affect the safety of its employees. According to recent reports by the General Accounting Office (GAO), DOE has failed to set up effective safety and health programs, and employees' complaints about unsafe conditions have gone unheeded. At the Fernald plant in Ohio, where DOE processes uranium for use in plutonium-production reactors, GAO found that radiation-protection policies adopted in 1960 had not been fully implemented some 25 years later.

Workers who handle wastes face special risks and are exposed to the highest levels of radiation. The job of transferring wastes from one tank to another, for example, requires extensive hands-on maintenance and monitoring. And tanks must be inspected for cracks, a job that entails opening a "riser cover" (akin to a manhole cover), dangling a light, and looking in. Radioactive vapors contaminate the surrounding air during this process.

Workers at DOE weapons plants must often clean

up after accidents and repair or decontaminate radioactive equipment. Remotely operated equipment should be available for some of these dangerous jobs. But funding levels for handling waste have been too low to develop such machinery. Especially in emergencies, the common practice is instead to mobilize hundreds or thousands of employees. For example, Du Pont sent in over 850 workers to clean up a severe spill in 1970.

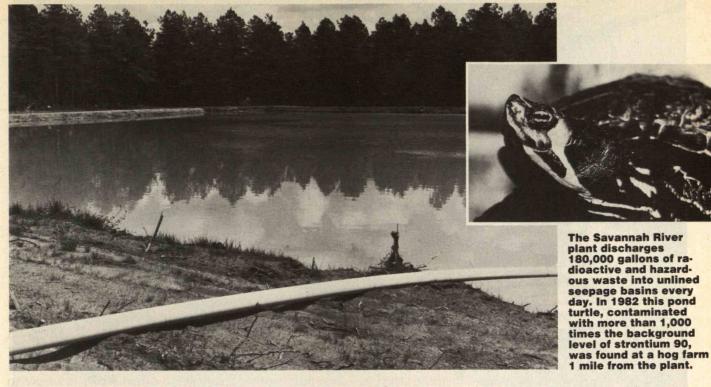
Stack releases have also posed serious risks to employees. In the late 1940s, a stack leak at Hanford's first reprocessing plant went undetected for an entire year and was not fully repaired for still another. Records released 40 years later show that AEC officials became aware that both guards and construction workers were being exposed to plutonium levels far above existing standards (which have since been considerably tightened). Yet the agency decided not to issue warnings or to take protective measures. Concern about such risks recently prompted the Centers for Disease Control to call for epidemiological studies of Hanford construction workers.

DOE itself has done 12 different studies showing that employees exposed to radiation contract excess numbers of cancers and other diseases. According to some of the reports, including one performed at Oak Ridge National Laboratory, workers involved in maintenance, cleanup, and construction bear the highest risk of dying from cancer.

Devising a Cleanup Plan

In 1983 DOE submitted a plan to Congress for longterm management of its wastes. The plan has three components:

- ☐ Wastes contaminated with plutonium and other heavy elements will be processed and buried in the Waste Isolation Pilot Project (WIPP), a repository in Carlsbad, N.M.
- High-level tank sludge will be solidified into glass and buried with wastes from commercial nuclear power in an underground repository. Congress recently designated Yucca Mountain, Nev., as the site for this waste after other targeted states mounted major political opposition.
- ☐ The low-level radioactive and hazardous liquids that remain in the tanks will be mixed with cement—in a process called "grouting"—and poured into con-



crete-lined pits on site.

Unfortunately, these plans are already several years behind schedule. And potential problems with each component cast doubt on DOE's commitment to developing an effective cleanup program.

For example, the plans for WIPP propose that, because of natural "creep," the salt bed will slowly close over the drums of wastes. Engineers assume that this geologic process will keep the wastes secure for thousands of years until the radioactivity is spent. But a 1983 study by scientists at Sandia National Laboratory and the state of New Mexico showed that brine could enter the site before creep seals it, saturating the wastes and possibly allowing them to escape to nearby water supplies. Perhaps that is why DOE has avoided complying with EPA standards requiring documentation of how the repository will work.

A recent National Academy of Sciences panel confirmed that DOE should perform further tests before proceeding, and criticized DOE for not having adequately studied the problem. The panel recommended that WIPP accept only 3 percent of the 120,000 barrels of waste ultimately destined for the site until the brine issue is resolved.

DOE's failure to thoroughly study the site is reminiscent of the AEC's 1963 choice of Lyons, Kans., for salt-mine disposal of radioactive wastes. Water pumped into test holes mysteriously disappeared. It turned out that previous mining and drilling for oil and gas had made the site "a bit like a piece of Swiss cheese," according to an official of the Kansas Geological Survey.

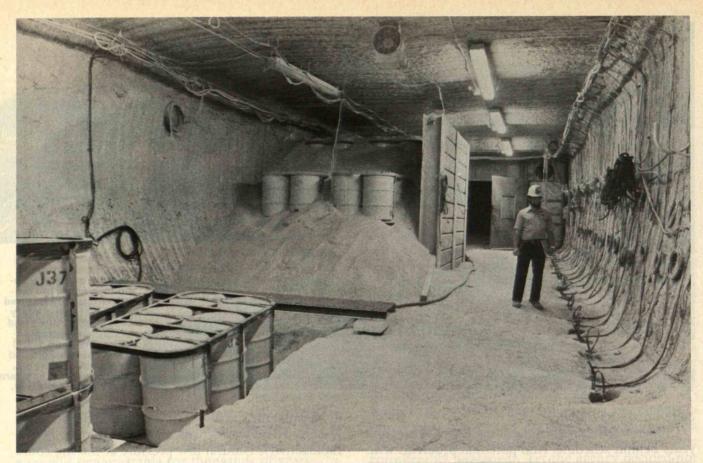
Similar problems could occur at Yucca Mountain

in Nevada, the site for storing "glassified" high-level wastes. These wastes will be very hot from intense radioactivity. Natural low pressure at the site could draw in water, which could flash into steam and disintegrate the glass. Again, DOE has not determined whether this form of disposal is suited to the area's geology.

Moreover, DOE has no experience operating a glassification plant, even on a pilot basis. Yet a \$1 billion facility is now being built at Savannah River and is set to begin operating within a year. And the glassification process is complicated and dangerous. Workers must remove sludge from the tanks, evaporate other high-level liquids and salts, and convert them into slurry. All these concentrated wastes will then be mixed with molten glass, and the substance cooled into cylinders.

France has operated a glassification plant, but it doesn't provide a good model because its wastes are acidic. DOE, in contrast, must handle neutralized material that could create explosive gases, and also form salts that plug jets and pipes. Merely transferring the highly radioactive wastes from the tanks where they are now stored to new ones for processing into glass could result in spills, as it has in the past. A spill of several thousand gallons of radioactive sludge onto the plant floor would pose a radiation hazard so severe that it could cripple any further operations.

DOE now wants to build a pilot-scale glassification plant at Hanford, and such a facility would indeed provide much-needed experience. Unfortunately, this is yet another example of putting the cart before the horse, since the full-scale facility would



start up before the pilot plant. Because any further delays would only postpone cleanup, DOE should run the main plant as a pilot operation, monitoring all processes carefully.

Dangers of Radioactive Cement

Grouting, the disposal method for low-level tank liquids, is yet another example of DOE's penchant for choosing the cheapest—but not necessarily most cost-effective—option. These liquids, called "supernate," are more dilute than sludge, but they still contain highly radioactive elements. DOE plans to mix some of these wastes with cement and place the grout permanently into shallow vaults on site.

The amount of long-lived radionuclides and other toxic substances that seep from these cement blocks over thousands of years will far exceed the amount already dumped into the ground. For example, DOE plans to allow 20 million times as much iodine-129 (half-life of 17 million years) to leach from the cement than Savannah River's two reprocessing plants routinely discarded over 20 years.

DOE had to loosen its plutonium soil-dumping standard to accommodate this form of waste disposal. The new standard—which permits 10 times more plutonium to be discarded—also means that only 30,000 cubic meters of soil will have to be moved from Hanford to WIPP, instead of some 12 million cubic meters. Without this change, there



TOP: At the Waste Isolation Pilot Project, or WIPP, in Carlsbad, N. Mex., a salt formation is supposed to close over 120,000 drums of plutonium-contaminated wastes. But studies show that brine may enter the repository, possibly allowing the wastes to escape.

ABOVE: Congress recently chose Yucca Mountain, Nev., as the site for high-level nuclear wastes, both military and civilian. But water at the site could flash into steam and disintegrate the intensely hot military wastes, which will be formed into glass.

would not be enough room in the New Mexico repository to house all the contaminated soil.

The process of making cement will also greatly increase the *volume* of low-level waste. Savannah River alone will produce about 1 million cubic feet of radioactive cement annually for 30 years. This is triple the total volume of low-level waste generated there during the first 22 years of operation, and twice the amount in the six dumps serving the nation's commercial nuclear power program. In our view,

Roughly 45 cents of each dollar spent to make bomb-grade material goes toward managing wastes.

this contradicts the philosophy behind cleaning up any kind of pollution: the goal is to remove it, not to create more of it. At the very least, DOE should separate out long-lived radioactive elements before

making the cement.

Solvents in the waste could pose special problems, since they may make the cement fall apart quickly. Yet DOE has not completed studies determining how well the grout will hold up. Incredibly, in an environmental impact statement for cleanup operations at Hanford, the agency says it chose this form of disposal on the grounds that "cement structures built more than 3,000 years ago are still standing." Obviously, most cement buildings erected even a few hundred years ago no longer exist. Thus, this form of waste disposal could dramatically worsen the already severe contamination of DOE's weapons-producing sites. At the very least, it means that the sites will be unavailable for other uses for centuries.

Another alternative for liquid wastes deserves further exploration. In "calcining"—a method of converting them into a powder—the wastes are sprayed through an atomizer and dried at high temperature. DOE has used this process at the Idaho National Engineering Laboratory, apparently without major problems, for over 20 years. A program to calcine the wastes at Hanford was killed in the late 1950s after the funds were used to build another production reactor. Calcining would not necessarily cost less in the long run, since the powder would have to be converted to another form for permanent disposal, but it would buy time until all the options could be studied.

The Long-Term Outlook

The soaring capital costs of waste cleanup are making the price of producing nuclear weapons astronomical. Roughly 45 cents of each dollar spent to make bomb-grade material now goes toward managing wastes. Cleanup and waste-handling operations already consume nearly \$1 billion yearly, almost an eighth of DOE's budget. And DOE's Joseph Salgado recently told a congressional subcommittee that full cleanup of both radioactive and hazardous waste at DOE sites could cost \$100 billion

As Frank Gaffney, former assistant secretary of defense, has written in the Wall Street Journal, "No industrialist could stay in business with the rate of

capitalization sustained for years by the nation's nuclear-production infrastructure. It is increasingly unclear whether the U.S. government's nuclear weapons complex can either"

weapons complex can either."

These costs are forcing DOE and Congress to reconsider the need for more plutonium. The aging reactors at Hanford and Savannah River must soon be replaced if production is to continue. Plutonium output has dropped substantially since 1986, despite a massive infusion of funds to shore up the decrepit facilities. DOE recently placed the Hanford N-reactor on "cold standby" because of public concern that it was unsafe; it may never reopen. Savannah River is operating its three reactors at only 40 percent capacity.

These plants have produced some 100 metric tons of plutonium over the past 40 years. Indeed, Energy Secretary John Herrington recently told Congress that the United States is "awash in plutonium." Thus, new material may not be needed. Progress in arms control could provide further impetus to

sharply curtail plutonium production.

Whether to build a new tritium reactor to replace the aging facility at Savannah River is a more pressing issue. Tritium has a half-life of only 12.3 years, so it must constantly be replenished in existing warheads. Tritium production does not create as much high-level waste, but cleanup is still a serious issue. Tritium is the most ubiquitous pollutant both on and off the Savannah River site, for example, and it remains radioactive for over one hundred years. Further need for this material deserves careful study.

In our view, plutonium production, as well as soil dumping of radioactive waste, should halt immediately: the public dangers are simply too high. DOE's de facto outlaw status in complying with environmental laws must also change. EPA should be able to enforce the same standards for DOE as for the private sector. And the only way to ensure that DOE effectively cleans up its wastes is to set up a long-term spending mechanism such as Superfund.

Regardless of how these issues are resolved, the radioactive and hazardous material that is the legacy of the nuclear arms race will affect surrounding communities for centuries. As Sen. John Glenn has said, "The costs of cleaning up these sites will be extraordinarily high, but the costs of doing nothing will be higher. After all, what good does it do to protect ourselves from the Soviets by building nuclear weapons if we poison ourselves in the process?"

The Stage Shifts in Arms Control

BY LEON V. SIGAL AND JACK MENDELSOHN

In conventional-forces
talks that could commence
this year, the Soviets may well
offer substantial reductions.
NATO should be
ready to deal.



of the superpowers' treaty to eliminate their intermediaterange missiles, the question of the conventional-force balance in Europe has moved to the forefront of the East/ West dialogue. After years of inconclusive talks on reducing those forces, the Soviets are now taking a potentially promising approach.

Until recently, the Soviets have tried without success to convince the West that no conventional-force imbalance existed in Europe. *Pravda* summed up the Soviet position in June 1978 when it announced that "an approximately equal correlation [of forces] with respect to numbers has been formed and exists in the center of the continent between the Warsaw Pact and NATO countries."

Mikhail Gorbachev signaled a basic shift in that traditional stance in an April 1987 speech in Prague. He openly acknowledged some Warsaw





The risk of inadvertent war exists because both sides' forces are poised to mobilize rapidly and attack first.

Pact advantages in conventional forces and called for asymmetric reductions: "In the West they talk about inequality, imbalance. Of course, there is asymmetry in the armed forces of both sides in Europe dictated by historical, geographical, and other factors. We are for eliminating any elements of inequality that have arisen, not through a buildup by those who are behind, but through a reduction on the part of those who are ahead."

Gorbachev first called for new talks on conventional-arms control in April 1986 aimed at a "substantial reduction" of ground and tactical air forces in

Europe. Europe, he made clear, extends "from the Atlantic to the Urals," well beyond the central front in Germany that has been the focus of past negotiations. The wider area encompasses the western Soviet Union, bringing much more of the Red Army within the scope of any limitations.

The new talks may start later this year. A far-reaching Soviet offer of asymmetric cuts, perhaps even unilateral ones, in Warsaw Pact forces seems likely within the next year.

The West's position is uncertain. Some, including Henry A. Kissinger, Alexander Haig, and General Bernard Rogers, the former NATO commander, are calling for strengthening NATO forces. They want to redress what they perceive to be a gross conventional-force imbalance in the Warsaw Pact's favor. They argue that without intermediate-range missiles

LEON V. SIGAL teaches international politics at Wesleyan University and is the author of Nuclear Forces in Europe (Brookings Institution: 1984) and Fighting to a Finish: The Politics of War Termination in the United States and Japan, 1945 (Cornell University Press: 1988). JACK MENDELSOHN served on the Special Political Committee for the mutual and balanced force reduction talks at NATO from 1977 to 1979 and was a member of the U.S. SALT II and START delegations. He is now deputy director of the Arms Control Association in Washington, D.C.



The West is considering a defense strategy that includes the use of precision-guided conventional weapons to break up enemy formations well behind battle lines. This strategy would involve an army tactical missile system, a mockup of which is shown here.

NATO no longer has the means to adequately deter attack. Some conventional-force improvements may be warranted, but we believe that conventional-arms control, plus mutual reductions in battlefield nuclear weapons, may be a better way to increase East/West stability and enhance the security of Europe.

If NATO is not to concede the political high ground to Gorbachev, it should be prepared to seize the initiative and offer serious proposals of its own. At a minimum NATO must thoroughly assess what it wants from the Warsaw Pact and what it is prepared to give in return, instead of hoping that the issue of conventional-arms control will fade from the public's attention.

Politically and economically, both sides stand to benefit from force reductions. But any reduction proposal, even one that offers asymmetric cuts in NATO's favor, will be militarily beneficial only if the character of the two sides' forces is taken into account. Forces on both sides of the East/West dividing line are poised to mobilize rapidly and attack first in a crisis. This raises the risk of inadvertent war. Simply worrying about the quantitative balance is not enough; negotiations must also cope with the qualitative sources of instability.

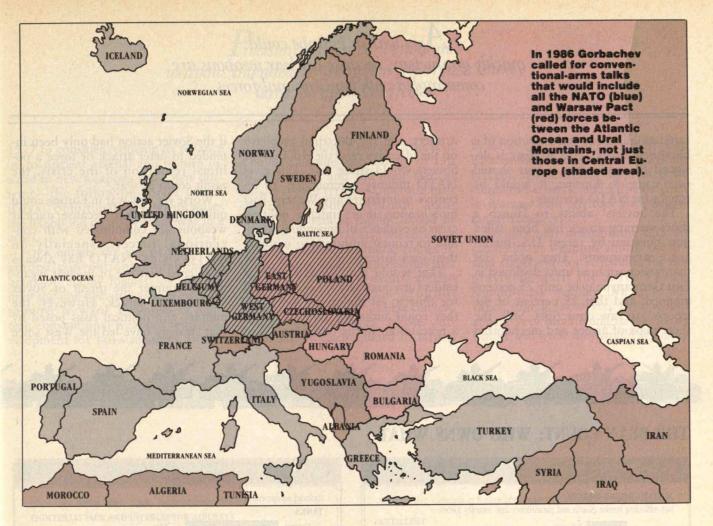
Bean Counting

The conventional wisdom in the West is that Soviet numerical preponderance in troops, artillery, tanks, and land-based aircraft gives the Warsaw Pact a decisive edge over NATO. Consider, for example, the key offensive elements-tanks and combat aircraft. The International Institute for Strategic Studies, a standard source, indicates that in Central Europe the Warsaw Pact has roughly 18,000 tanks to NATO's 12,700. In combat aircraft, the same sources give the Warsaw Pact approximately an 1,800 to 1,200 advantage.

However well this assessment of NATO deficiencies may serve defense ministries in budget season, it misconstrues and exaggerates the military relevance of the imbalance. If sheer numbers or firepower alone could dictate results, then Israel would have lost its wars with the Arab states and the Spanish Armada would have had clear sailing.

Bean counters imply that the two sides must match each other soldier for soldier and tank for tank if deterrence is to succeed. Yet the unstated assumption that only tanks can fight tanks is fallacious. Infantry with hand-held anti-tank weapons and aircraft with precision-guided munitions can destroy tanks, too. Barriers such as forests, rivers, cities, trenches, mines, and steeply banked highways can impede the ability of tanks to sweep across Europe. And defenders do not require as many tanks as attackers do.

Bean counting also understates numerical asymmetries that favor the West and underweighs qualitative factors that could well prove decisive in the event of war. For instance, sheer numbers obscure the fact that 47 percent of Warsaw Pact tanks in Central Europe are models that entered service before 1965, whereas only 5 percent of NATO tank models did.



To count only land-based aircraft is to ignore the enormous advantage NATO enjoys in carrier-based planes, which will be available at least at the start of hostilities. NATO has twice as many attack aircraft as the Pact on board carriers now in European waters, and the United States can move others into the theater. In addition, valuing every airplane equally discounts the West's advances in avionics and other technology, and disregards the West's superior pilot training and morale. In 1986, the Chief of Staff of the U.S. Air Force stated that the Soviet Union was 10 years away from deploying combat aircraft comparable to the U.S. F-15 and F-16.

Some bean counters base their assessments on doubtful political premises, if they do not ignore politics altogether. When they include 230,000 Polish Army troops and 3,400 tanks in the Warsaw Pact totals while omitting 280,000 French Army troops and 1,500 tanks from NATO's count, they make unwarranted assumptions about who will fight whom under what circumstances. The poten-

tial instability in Eastern Europe is in itself a daunting deterrent to Soviet military planners, who no doubt realize that by calling on their allies to attack the West they could provoke unrest. And France's vaunted independence from NATO may have more to do with domestic political appearances than with international military realities. No more than 275 milesand as little as 130—separates France from the frontier between the two Germanies. That geographic fact of life would motivate France's military cooperation with West Germany in the event of World War III, even if domestic politics suggest not being too explicit about joint planning.

In its worst-case form, bean counting is self-defeating. After assessing the numbers, some have called for NATO to add 10 or so divisions to offset the Warsaw Pact's numerical advantage. This makes demands that are not only militarily questionable but also politically and economically unsustainable. As a result, some European parliamentarians have dismissed any efforts at redressing the

balance, and others have based their hopes on the presumed peaceful intentions of the other side.

Even more fundamentally, the focus on numerical advantages draws attention to the least likely scenario—premeditated war. NATO's conventional deterrent and the risk of escalation make such a path unlikely. The real danger is that of inadvertent war in a crisis, and current efforts by the Reagan administration to modernize and improve weapons could increase the odds of this.

How Inadvertent War Could Start

Conventional forces on both sides have been positioned and military strategies designed so that they could accidentally ratchet up a confrontation into a full-scale war—just as a series of competitive mobilizations turned what began as a local war into a world war in August 1914.

To understand how this could happen, recall that Soviet military doctrine has historically placed a premium on seizing the initiative by

Any war in Europe could quickly go nuclear, because nuclear weapons are commingled with conventional forces.

rapid mobilization and execution of a blitzkrieg attack. This strategy is designed to assure that if war should ever come to Europe, it would be fought on NATO territory.

The Soviets' ability to launch a short-warning attack has been called into question by recent U.S. intelligence assessments. They point out that Soviet armored units deployed in East Germany may be only 75 percent manned, and that 25 percent of the troops are raw conscripts. Still, the sheer mass of armor and mechanized

artillery and the doctrinal emphasis on the offensive raise the risk that the Soviets would strike first. This gives NATO military commanders an incentive to interpret any Warsaw Pact mobilization in an intense political crisis as evidence of impending attack and to request authority to mobilize their own forces.

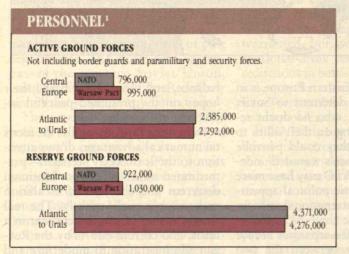
That would put Western political leaders in a quandary. They could stall for time to let diplomacy work. Or they could authorize mobilization as a precaution. In the latter case, even

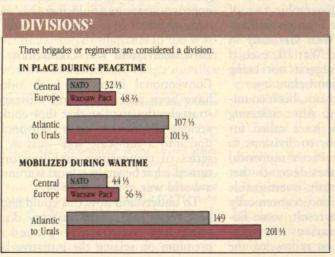
if the Soviet action had only been intended to deter attack or force a political resolution of the crisis, the result could be war.

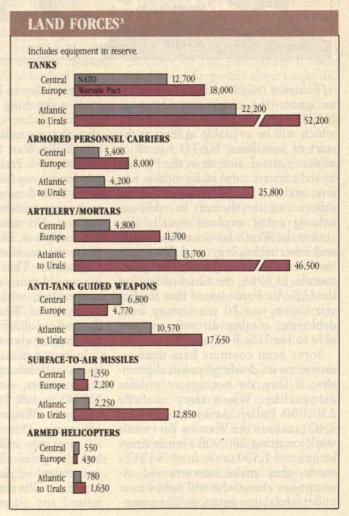
Worse yet, any war in Europe could quickly go nuclear because nuclear weapons are commingled with conventional forces, especially on NATO's side. NATO has always threatened first use of nuclear weapons to counter the threat of Soviet conventional attack. However, the military and political risks posed by that strategy have led the West since



THE BEAN COUNT: WHO OWNS WHAT







Precision-guided conventional weapons intended to strengthen deterrence could have the opposite effect.

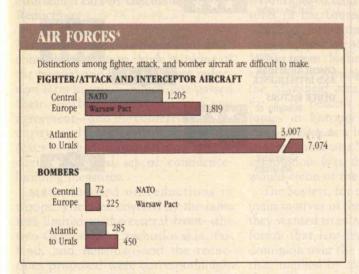
1977 to consider reducing its reliance on its nuclear arsenal and to turn instead to new weapons and a new doctrine-the follow-on forces attack (FOFA). Unfortunately, FOFA increases the likelihood of inadvertent war in a crisis.

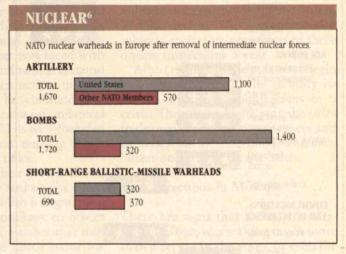
FOFA entails the use of precisionguided conventional weapons to break up enemy formations well behind the line of battle as they prepare to move forward. Examples of hightech conventional weapons under development for FOFA missions are the army tactical missile system (ATACMS), a ballistic missile with a range of 150 to 300 miles, and the joint tactical missile system (JTACMS), a cruise missile that incorporates "stealth" technologies to reduce the likelihood of radar tracking. ITACMS, which has a range of at least 50 miles, comes in two versions: an air-launched one that the air force wants to deploy aboard B-52 bombers, and a groundlaunched army version. These conventionally armed missiles, whose warheads are precisely guided to targets

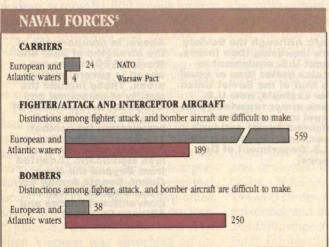
by sensors, are capable of penetrating Eastern air defenses and attacking bridges, rail junctions, supply depots, command centers, and airfields deep in Warsaw Pact territory with devastating accuracy.

Skeptics may question the claimed capability of weapons still in the design stage and not scheduled for deployment until the early 1990s. Should these weapons live up to advance billing, however, they would appear very threatening to the Soviet Union, and while they would arguably







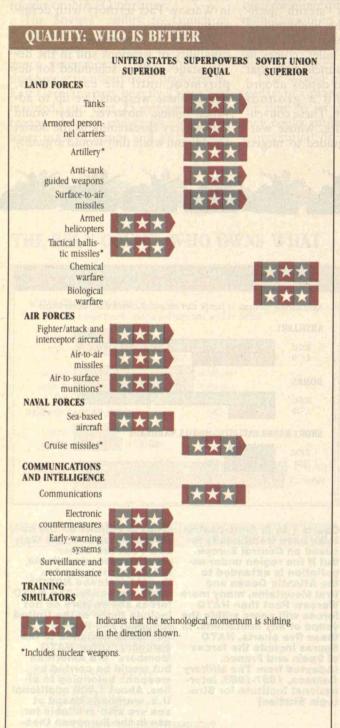


Charts 1 to 5: Arms-control talks have traditionally focused on Central Europe. But if the region under negotiation is extended to the Atlantic Ocean and Ural Mountains, many more Warsaw Pact than NATO forces will come within the scope of any limitations. In these five charts, NATO figures include the forces of Spain and France. (Adapted from The Military Balance, 1987-1988, International Institute for Strategic Studies)

Chart 6: Figures on the nuclear warheads of the Warsaw Pact are either unreliable or unavailable, but their totals are believed to exceed NATO's 4,080 warheads. The NATO forces shown here do not include those of the United Kingdom and France. The warheads assigned to the category "Other NATO Members" are American but would be carried by weapons belonging to allies. About 1,000 additional U.S. warheads based at sea are also available for use in the European theater. (Adapted from the **Arms Control Association)**

Until recently, the underlying motives of the superpowers all but precluded agreement to cut conventional forces.





	NATO SUPERIOR	NATO, WARSAW PACT EQUAL	WARSAW PACT SUPERIOR
FORCES			
Number of			***
weapons systems Quality of	Andrew Pro	de Extemples	University (Inc.)
weapons systems	***	al weapons u	
Number of	- NA - SK	Market Street	
personnel		MAK	
Quality of	+++		
personnel			
Willingness to mo- bilize first in a crisis			***
Capability for surprise			September 1
attack and defense			***
Level of prepara-	***		
tion for combat			
Ability to sustain a war			***
Ability of forces			MATTER VALUE OF
to work together			
COMMUNICATIONS AND INTELLIGENCE		*7*	
OTHER FACTORS		ALL PROPERTY.	
Reliability of			
allies		Charles of the	
Economic and indus- trial strength	***		
Geographic			
advantage			***
, ,			And the contract of

Left: Although the Soviets are improving their forces, most U.S. equipment remains better than or equal to that of the Soviet Union. For example, new U.S. tank armor reportedly can repel any existing or planned Soviet anti-tank weapons. (Adapted from U.S. Department of Defense)

Above: In comparisons of the strengths of East and West, NATO comes out ahead in several critical areas. These include the quality of personnel and weapons, the reliability of allies, and the level of preparation for combat. The fact that the Warsaw Pact has more weapons is less significant. (Adapted from Beyond the Bean Count, Senate Armed Services Subcommittee on Conventional Forces and Alliance Defense)

Gorbachev might be preparing the ground for a substantial unilateral reduction that could transform Europe's political environment, pitting ally against ally.

strengthen deterrence, they would do so at the risk of provoking the Warsaw Pact to strike first in a crisis.

For the sake of military stability, it is in NATO's interest to seize the initiative in conventional-arms control. Yet, unfortunately, the Soviet Union is likely to take the lead. The reasons are that NATO is hopelessly divided on this issue. The requisite political leadership is absent in the West, and past results in conventional-arms control have lowered expectations, most notably among those with experience in the negotiations.

Fourteen Years of Discussing Reductions

Many old hands in conventional-arms control continue to think in terms of the mutual and balanced force reduction (MBFR) talks—which just passed their fourteenth year without any agreement—and the conference on security and cooperation in Europe (CSCE)—which took nearly as long to devise a limited set of confidencebuilding measures.

MBFR focused on reductions in troops. The area covered by the talks was limited to the central front—the two Germanies, Czechoslovakia, Poland, and Benelux—and the reductions proposed were correspondingly modest: at most 91,000 troops for the West and between 105,000 (a Warsaw Pact proposal) and 262,000 (a NATO proposal) for the East. More recent proposals spoke of cutting only 13,000 troops or less of the 1,000,000 or so on each side in Central Europe.

That the MBFR talks did not produce an accord should come as no surprise. Despite the best efforts of some dedicated negotiators, the underlying motives of the two sides all but precluded agreement to cut conventional forces. NATO wanted to keep allied forces, both conventional and nuclear, in place on the continent. At a time when Vietnam was absorbing an in-



Past talks on the conventional balance in Europe have resulted in limited confidencebuilding measures, such as the right of one side to inspect certain military exercises on the other side. This U.S. army colonel is exercising that right, visiting Soviet soldiers.

creasing amount of U.S. military resources, Western military planners were trying to fend off domestic pressures in the United States and elsewhere to "bring the boys home" and to cut defense spending on Europe. In 1970, when National Security Advisor Henry Kissinger was faced with the Mansfield amendment's demand for a 50 percent reduction in U.S. forces in Europe, he countenanced "using MBFR as a brake on unilateral congressional cuts." His well-founded assumption was that nothing much would come of the talks.

The Soviets, for their part, had two main motives in the MBFR talks. First, they wanted to establish a negotiating forum that lent legitimacy to Soviet dominion over the East. Another motive, implied by the East's name for the talks-mutual force reduction, omitting "balanced"-was to demonstrate that no conventional imbalance existed in Europe. But the East's behavior on what came to be known as the "data question" only hardened perceptions in the West that the opposite was true, whether or not it was.

The data question revolved around differences in the two sides' estimates of the size of forces deployed in the area of Central Europe covered by the talks. NATO had by its count 744,000 troops and 198,000 air force personnel and ascribed 956,000 and 244,000, respectively, to the Warsaw Pact. Information presented by the Pact put its totals at 815,000 and 182,000. The discrepancies were partly caused by the East's omitting some categories of active duty personnel, and partly by the West's miscounting. The issue was never cleared up to the West's satisfaction, however, and became a source of mistrust as well as a barrier to agreement.

In contrast to the MBFR talks, the CSCE negotiations did culminate in a set of confidencebuilding measures. The agreement, signed in September 1986, obliges the 35 participating states to notify each other in ad-

vance of all military exercises and movements exceeding 13,000 troops or 300 tanks. In addition, the states must invite each other to observe all military exercises involving more than 17,000 troops. The agreement also subjects each state's exercises to three on-site inspections a year.

Albeit modest, these measures begin to get at the crux of the stability issue-competitive mobilizations in a crisis. They do so by helping the sides to distinguish between maneuvers and exercises on the one hand, and mobilization for war on the other.

New Directions in Moscow

There are signs that the new leadership in Moscow is seeking much more than a repeat of the MBFR or even the CSCE discussions in the upcoming talks on conventional-arms control. The Soviets seem to be preparing the ground for asymmetric reductions in Warsaw Pact conventional forces, either as a negotiating position or as a unilateral gesture. If the action takes the form of a substantial unilateral reduction, it could transform the political environment in Europe. That could pit the right against the left, if not ally against ally, over the issue of how best to deal with a more accommodating Soviet Union.

Gorbachev has introduced a number of new concepts that have yet to be fully elaborated. They nonetheless

Dismissing Moscow's overtures would be especially inappropriate since the West cannot afford to maintain the status quo.

At its June 1986 meeting in Budapest, the Warsaw Pact called for negotiating deep cuts in conventional arms and nuclear weapons with ranges up to 1,000 kilometers. Gorbachev could conceivably sweeten the proposal by unilaterally withdrawing several tank divisions and demobilizing others.

mark the start of an internal debate in Moscow over a new line that could justify substantial cuts in Soviet tanks and artillery. For example, Gorbachev has replaced the term "parity" with "reasonable sufficiency" in his discussion of Soviet military requirements. The term reasonable sufficiency has the connotation not only that enough is enough, but also that less will doat least for the moment. Leonid Brezhnev foreshadowed this theme in his 1977 speech at Tula, formally renouncing superiority as an objective of Soviet nuclear policy. Now Gorbachev has extended this renunciation to conventional forces.

In July 1987, Defense Minister Dimitri Yazov amplified the new terminology. "Proceeding from the principle of sufficiency," he said, the Warsaw Pact proposes "to reduce, on a mutual basis of course, the military potentials to such a level where neither of the sides, while ensuring its defense, has the forces or means enabling it to mount offensive operations." This statement implies a farreaching shift in Soviet military doctrine away from its blitzkrieg strategy.

Arms controllers in the Soviet academies, with access to the Politburo, have gone still further. They have extended reasonable sufficiency to cover unilateral measures to limit and reduce arms. An article published in December 1987 in the journal of Moscow's U.S.A. and Canada Institute states, "From all appearances, reasonable sufficiency should envisage the possibility of a flexible combination of unilateral, bilateral, and multilateral measures in the sphere of arms limitation."

At its annual meeting in May 1987, the Warsaw Pact invited NATO to a dialogue among military experts for the purpose of "insuring that the military concept and doctrines of the military blocs and their members rest on defensive principles." In such a dialogue the East could obviously draw attention to NATO's doctrine of first use of nuclear weapons, and to its novel concepts for high-tech conven-

tional war. But the talks would also allow NATO to focus on the number of Soviet tanks and artillery deployed in Eastern Europe and their implications for crisis instability.

A communiqué issued by the Warsaw Pact at its June 1986 meeting in Budapest provides substance to the vague intimations about deep cuts. It calls for negotiations to reduce conventional arms, as well as nuclear missiles and artillery with ranges up to 1,000 kilometers—the so-called battlefield or tactical nuclear weapons. It distinguishes two stages of reductions. An initial cut of 100,000 to 150,000 troops on each side would be accompanied by constraints on tactical air power, where the Pact deems NATO to have clear superiority. Also, the two sides' "military activities"-presumably exercises—would gradually be reduced as a means of building confidence. In the second stage, land forces could be further reduced by up to 500,000, and tactical aircraft by up to 25 percent.

If all the Warsaw Pact is up to is trying to constrain NATO's tactical air capability without making substantial cuts in its own tanks and artillery, then the proposal will go nowhere.

Yet the Soviets may soon be willing to make NATO a more attractive offer, because conventional-force reductions and changes in strategy appear integral to Gorbachev's overall domestic and foreign-policy program. Arms controllers and hard-liners alike see the Soviets driven by a need to reclaim scarce economic resources from the military sector. Both groups are prone to overstate this motive. The centrally controlled Soviet economy can direct money and personnel more readily than the U.S. economy. Even so, Gorbachev does seem personally committed to keeping the lid on defense spending, and conventional forces consume roughly four times the budget that nuclear forces do. There seems to be a more fundamental objective behind the Soviet quest for force reductions, however. Gorbachev

wants to restructure the Soviet economy so that it can generate and sustain technological advance internally. But economic restructuring takes time, and a relaxation of tensions is needed to buy that time.

Despite these motives, the Soviets are unlikely to agree to major cuts in their conventional forces in Europe without offsetting constraints on Western conventional technology. Starting with former Chief of Staff Nikolai Ogarkov, Soviet military leaders have worried openly about a looming technological competition with the West—ostensibly in space but with more practical applications on the ground—to enhance conventional capabilities. The Red Army is especially concerned about technological advances associated with NATO plans for attacks on forces far behind the line of battle (FOFA). If constraints on Western conventional-force improvements were traded for disproportionate cuts in Soviet tanks and artillery, Moscow would have breathing room to reallocate money and personnel, especially high-tech talent, to non-military purposes.

How far-reaching an offer might we expect the Soviets to put on the table? Gorbachev, for one, seems to recognize that further progress in nucleararms control-indeed, détente in Europe-is hostage to the widespread Western perception of a conventionalforce disparity in the Soviets' favor. Only a significant unilateral gesture by the Soviet Union could dispel Western fears of a denuclearized Europe exposed to a Soviet conventional juggernaut. Just putting forth a "proposal" for negotiated asymmetric reductions would not suffice. But unilaterally withdrawing three or four combat-ready tank divisions from East Germany and Czechoslovakia and demobilizing 10 or more armored divisions that are deployed at about half their strength in the western Soviet Union would have the necessary dramatic effect.

Gorbachev, who has already shown himself to be the master of the bold



stroke, could well appreciate the political value of a unilateral cut. Such a move would make it difficult for NATO to proceed with its conventional-force improvements—not to mention the modernization of its short-range nuclear forces agreed upon in 1983 at the meeting of defense ministers in Montebello. Gorbachev's gesture would also prepare the ground for agreement on substantial cuts in conventional forces—on the order of 25 percent. It would open the way to further reductions in nuclear forces, both in Europe and in the superpowers' strategic arsenals. And it would clear the air for further mutual accommodation on political and economic fronts.

One danger Gorbachev faces is that a significant withdrawal could loosen the Soviet grip on Eastern Europe, especially in the current climate of economic restructuring. Moscow may fear that economic reforms, although slow to catch on at home, may spread like wildfire in Eastern Europe, kindling the sort of unrest that has led to Soviet military intervention. Yet Gorbachev may be prepared to run that risk. As suggested by the 1980-81 events concerning Solidarity in Poland and the 1988 withdrawal from Afghanistan, the Soviets have grown more reluctant to bear the costs of military intervention or the economic support that inevitably follows. In any event, the number of tank divisions in

Eastern Europe far exceeds what is needed for maintaining or restoring domestic order.

Finally, a substantial asymmetric cut in armor would adversely affect the Warsaw Pact's ability to execute a blitzkrieg, but the Pact's own assessments cast doubts upon the potential success of such a strategy.

The West's Response

As yet, recently retired NATO Secretary General Lord Carrington and the British and West German governments seem to be taking the Soviet signals seriously. Many in NATO dismiss the political impact of a potential unilateral reduction by the Soviets. Others console themselves with the belief that such a move would risk Soviet control over Eastern Europe, and conclude that Gorbachev will therefore never make it.

A failure to take the Warsaw Pact seriously would be especially inappropriate because the West cannot afford to maintain the status quo. The cohort of 18-year-olds, especially in West Germany, is certain to shrink in the near future, leaving fewer young people to enter the military and work in the factories. The prospect of a recession and the resulting domestic demands are bound to put pressure on defense budgets. And domestic politics in Europe is unlikely to prove receptive to new force deployments,

particularly in an era of renewed hope for détente.

Instead of looking askance at Warsaw Pact arms-control initiatives, NATO should test Soviet intentions by taking the lead. It could propose to reduce substantially or eliminate its own battlefield nuclear weapons-artillery and short-range missiles. It also could offer to constrain modernization of its aircraft and conventional missiles. In return, the Soviet Union would have to withdraw and disband substantial numbers of tanks and artillery, as well as eliminate its shortrange weapons that can be armed with conventional and chemical as well as nuclear warheads. That deal would ease the greatest fears of both sides in a crisis.

If this is more initiative than NATO can muster, it might prepare to reciprocate any unilateral move by the East with a gesture of its own. For instance, it might withdraw 1,000 short-range nuclear weapons from Europe that are located on the East/West frontier, where they are vulnerable to being attacked or overrun. Alternatively, NATO could modestly reduce its conventional forces and delay some qualitative improvements. These steps would help NATO regain the political high ground. They might also give NATO time to prepare a negotiating position of its own, rather than simply trying to resist an inevitable Soviet move toward reductions.

PHOTO: SOVFOTO TECHNOLOGY REVIEW 61

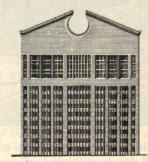
Philip Johnson: Architect of Kings

HIS is the Age of Philip Johnson. The legacy of America's most famous and visible architect is written across the face of the country. For half a century, Philip Johnson has altered America's building, not only in the style but in the spirit of the age. By introducing and endorsing two major movements—first, the right-angle world of modernism, and, little more than a generation later, the inflated historical forms of postmodernism—he has become the most influential designer of our century. His chippendale-topped, postmodern AT&T building in New York is to our age what the dome of St. Peter's was to the Renaissance—the major symbol of its time.

But more than facade and style account for the dominance of this elder statesman of design. By popularizing modernism and postmodernism and selling them to the builders of America, Philip Johnson has brought architecture into the media age. Style-monger, historian, curator, image-maker par excellence, Johnson is, above all, the man who has propelled architecture to public notice in an era that values

celebrity above all else.

Fame has come dear, however. Johnson's work has infuriated city planners, agitated critics and architects, and made even ordinary citizens ask what the cityscape has to do with "style wars." Johnson, observers contend, has concentrated on imagery, ignoring architecture's traditional stewardship of physical content and social context. He has courted developers and become the "architect du roi"—architect to the king—rather than considering the care and feeding of the broader community and environ-



Philip Johnson is
America's elder statesman
of architecture. But all
too often his work has
played havoc with
urban design.

ment. On occasion, he has even disowned engineering as a tool of his art. "I don't care how they widen the roof," he once said. "That's for the technical people. Let them jam straw [in it]," he went on, flicking off the physics of the field.

How does the 81-year-old master architect respond to his influence

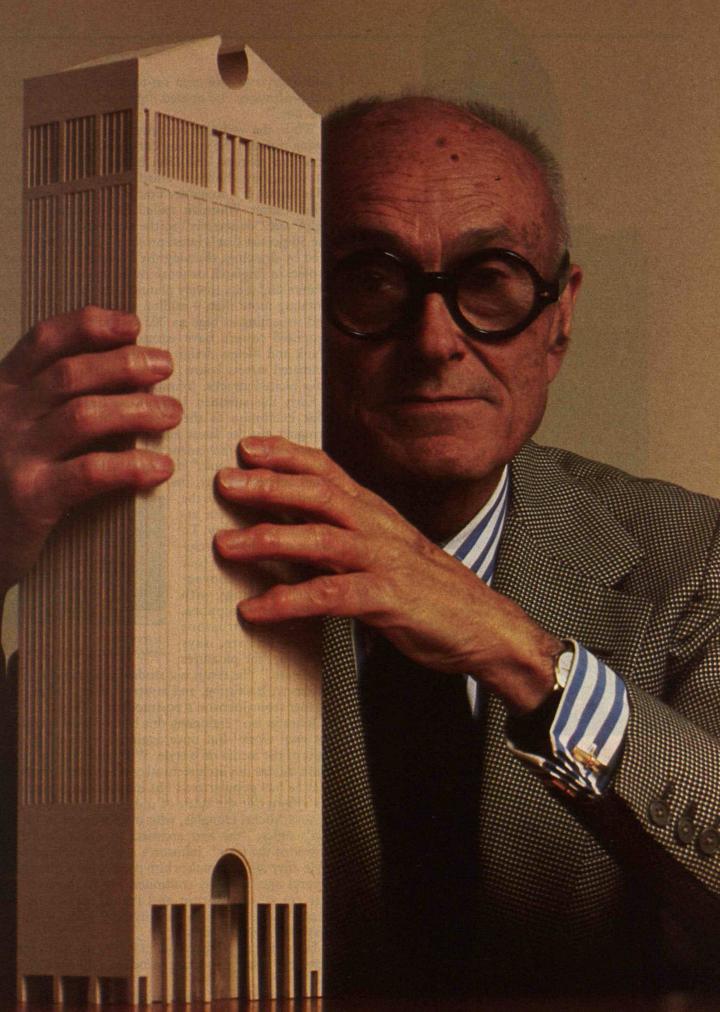
and infamy?

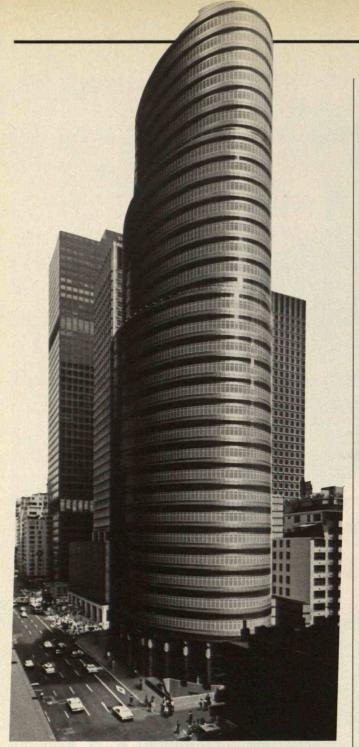
In the classic serenity of the University of Virginia campus half a dozen years ago, Johnson summed up his approach to the noble art of architecture and the controversy surrounding his name with a pronouncement: "I am a whore." The man who had appeared on the cover of *Time* in 1979 as a symbol of the oldest of the arts told his colleagues

he was a member of an even older profession and "got well-paid for it." In a dialogue with his peers, the architect described his role as a hireling in the

brothel of American building.

Needless to say, Johnson's comment didn't sit well with architects. No other has ever offered so outrageous a "blueprint for commercial survival" as Jaqueline Robertson, head of the University of Virginia's School of Architecture, put it. Despite a background of tolerance for Philip the playful, despite familiarity with Johnson's comments that he has "no principles" and was "anti-human," the architectural community found the line about prostitution intolerable. Recorded in *The Charlottesville Tapes*, a widely read transcription of the conference, it embarrassed both his clients and his profession. And lest anyone think the statement simply flip, the slim architect with the black owl eyeglasses did not demur. Calmly, Johnson reiterated his view in speeches





Philip Johnson Works in the Oval "Lipstick" building—Officially Named 53RD at third—Where he continues to promote one architectural style after another. Designed by Johnson and his partner John Burgee, the New York Skyscraper was completed in 1986.

JANE HOLTZ KAY is architecture critic for The Nation, correspondent for Progressive Architecture, contributor to the Christian Science Monitor, and author of Lost Boston (Houghton Mifflin: 1980) and Preserving New England (Pantheon: 1986).

and interviews and even on television. "It's a very old profession," he opined. "And used to be a normal one."

While the verbiage continues, so does Johnson. Swing through the curving corridors of the oval offices that Johnson and John Burgee, his partner of 21 years, have built on Third Avenue in midtown Manhattan. It's no matter that New York magazine critic Carter Wiseman called the building "plug ugly" and "dangerous" to the streetscape. Observe the 50-person firm's latest projects—four desks covered by drawings showing the 10-acre Long Bridge project in England, or work on four overscaled red granite-and-glass towers planned for Times Square. Totaling more than 4 million square feet of space, and stretching as high as 705 feet into the sky, the proposed towers have earned criticism for their blank and lifeless design and their incursion in the animated streets below. But so what if the towers have incited attacks: Johnson's influence endures.

Early this summer, Johnson set forth a cuttingedge exhibition at the Museum of Modern Art, bringing out the latest architectural style: "deconstructivism." A movement that wags call "the thriftshop Madonna look," this style includes the calculated ugliness of, say, the security fence and corru-

gated steel applied to the home of California architect Frank Gehry. To achieve the look, architects dissolve the four trim walls of conventional buildings with projections, disruptions, and other intrusions that emphasize, says Johnson, "the pleasures



GEHRY HOUSE, SANTA MONICA, CALIF., 1978.

Johnson, "the pleasures of unease." The result is a studied chaos and a "disharmony, fracturing, and mystery" that couldn't be further from Johnson's postmodernist design.

Johnson isn't endorsing this bravest new world in his own work—but once again he is beaming the light of the media on a style. Will Johnson, the publicist, diffuse this architectural concept like the others that he has popularized? His instincts are uncanny, his affinity for the spirit of our times unfailing. He is, says Michel Douglas, who once worked in Johnson's office, "the first architect to understand the power of the icon." Johnson's ability to spread one style after another makes him perfect for a pluralist, amoral age, Douglas continues. He is "perfect for our era of corruption and trendy urban decadence"—one in which "if anything goes, nothing matters," Douglas says.

In the age of celebrity—in a media age with publicity the most important product—Johnson's sig-

nature continues to spread across the skylines of America. What does his success say of our architecture, our cities, and ourselves?

An Architectural Prodigy

Philip Cortelyou Johnson was born to a silver-spoon setting in the Midwest in 1906 and continued to be blessed by fate and fortune thereafter. The son of a father who was a wealthy Cleveland lawyer and a mother "who wanted a Frank Lloyd Wright house and who traveled with me in Europe," the fair Midwesterner finished Harvard in 1930.

Stars had fallen on architecture in the 1880s, as a critic put it, and by the time Johnson headed to Europe on a post-college tour, that continent's land-scape was illuminated with the work of modernist designers looking to reform the world through their work. They believed that buildings tooled to the simple assembly-line style of the machine would bring better and less costly design to the masses.

Buildings by Le Corbusier, Mies van der Rohe, and other pioneers made Europe a mecca for the 24-year-old and a tutor who would be the envy of any architectural neophyte: Henry-Russell Hitchcock. Hitchcock, a few years older and destined to become the major architectural historian of the century,

would help turn Johnson into a prodigy.

Johnson returned to New York the same year, at the infancy of contemporary U.S. building design. He helped found the department of modern architecture at the Museum of Modern Art. Two years later, he and Hitchcock organized a landmark exhibition—"The International Style: Architecture Since 1932." It was a turning point in the transfor-

mation of the weary classicism that was languishing on the American landscape. But in the United States the new concept arrived severed from its moral source. In the exhibit, Johnson simply imported the look of the new design stripped of its social and moral principles.

"In Europe," John Winter writes in the encyclopedic Contemporary Architec-

ture, "the modern movement in architecture was closely related to social problems: it involved a belief that the good life must be for everyone, and working-class housing was considered a major building type. Philip Johnson, the hedonist, filtered out these notions of social responsibility." The American versions of the movement took hold as facade: highrise boxes on stilts to serve only a corporate clientele.

It was not enough to display this art, however. Soon Philip Johnson the curator set out to become Philip Johnson the architect. In 1940, in his midthirties, Johnson joined the young turks of modern architecture as a student at Harvard's Graduate School of Design, where heros like Walter Gropius, founder of the Bauhaus movement, were teaching studio classes.

Johnson at Harvard was a social success. The embodiment of trim elegance, he entertained his peers; more cosmopolitan and better connected than his fellow students, he went beyond their paper-bound projects. Ash Street in Cambridge still bears the boxy building based on Mies van der Rohe's work that Johnson created as his student thesis. Classmate George Lewis, who 50 years later helped lead the charge against Johnson's Times Square towers, says Johnson "was in complete control and it was very, very good design."

After school, Johnson moved to New Canaan, Conn. Here, at age 43 in 1949, Johnson embodied his passion for Mies's designs in his own first major work—a house. Structurally splendid, with four transparent glass walls, the one-story building spilled out on its private, rolling site. The magnificent jewel box was elegant in its exterior lines and inspiring in its interior space. However much the house owed to

Mies, it was Johnson's masterpiece.

Not only did the architect have the skill to shape this steel-and-glass manifesto and the presence to actually live in its see-through form, but he had the vision to call the glass house . . . the Glass House. That image-making skill, the gift of creating a symbol as easily read and transmitted as a one-liner, would become his most telling art. Combined with



GLASS HOUSE, NEW CANAAN, CONN., 1949.

the ability to appropriate someone else's past and display it with aplomb, that talent would catapult Johnson into prominence.

Johnson's next works fulfilled some of his early promise. The architect produced some well-designed private homes and some well-received bigger buildings, such as the 1950 trim glass-and-steel annex to the Museum of Modern Art. With Mies, Johnson



HOUSE OF SEAGRAM, **NEW YORK, 1957.**



EAST WING (RIGHT), MUSEUM OF MODERN ART, NEW YORK, 1964.

helped create another modern classic in 1958, the Seagram building on New York's Park Avenue. The steel-framed, glasscovered building became the model for American architecture for almost two decades.

Notwithstanding such work, by the 1960s Johnson's artistry seemed to flag in a series of mediocre buildings. From 1961 with the Amon Carter Museum in Fort Worth, Tex., and the New York State Theater at New York's Lincoln Center, to 1973 with the Boston Public Library addition, Johnson's works were often unimaginative, overblown gestures. Many of his buildings seemed pompous and slick, caricatures of older designs. In his commission for the

Boston Public Library, Johnson (with John Burgee and the Architects Design Group) created an annex that was cumbersome compared with its classical forebear, and light years away from his earlier modernist statements. In these years, Johnson's influence seemed to stem more from his role as salon-keeper and intellect than as architect.

But a new era was at hand.



NEW YORK STATE THEATER AT LINCOLN CENTER. NEW YORK, 1964



BOSTON PUBLIC LIBRARY ADDITION, BOSTON, 1973.

Philip the Centerfold

"When Neimee gives you the cartee blanchee, by God, you know you've arrived," the architect declared in 1975. It is in Neimee (Neiman Marcus) land that Johnson and the quiet gentleman's art of architecture entered another age. On the broad plains of Texas, unregulated by any officialdom or public values, architecture as showpiece entered the spotlight. The external image of a building became more important than its innate structural qualities. And Philip Johnson, the tall stranger who strode into town and took over center stage, was the People magazine hero of the new approach.

Working for Houston developer Gerald D. Hines, Johnson (and Burgee, who would work with Johnson on all designs to come) turned the eyes of America toward style and its deity—novelty. "It took me years to get across the idea of the International Style," Johnson observed. "Now the whole switch happens from one year to the next. You publish a new design, and within five minutes the whole world

view turns at right angles."

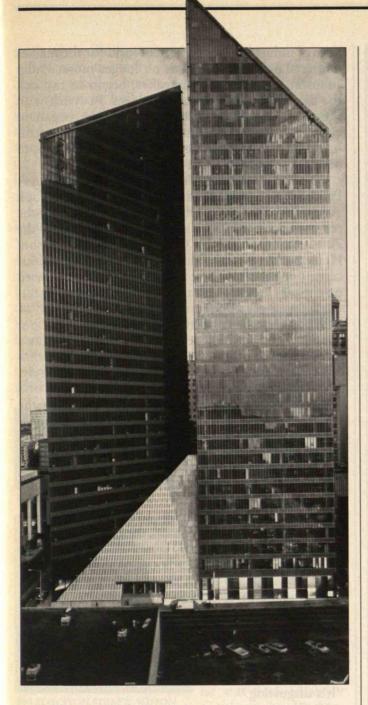
"Designer architecture" was born in Houston when Johnson altered the austere modernist shape into a more conspicuous design. For Hines's Pennzoil Place, Johnson began by simply "sawing off" the top of the highrise. Instead of designing one flat-topped rectangle, he shaped two diagonally sheared, connected black towers. Tilted toward more traditional architecture, with its peaked roofs, yet glassy and modern, the Pennzoil skyscraper would capture the eyes of Texas and sell the commercial space, Hines thought. Given the budget-first way of American development in the mid-1970s, the concept was daring. And—despite fears that the cramped and angular corners of the upper floors wouldn't rent well—the pitch was right. The towers sold. Pennzoil had prestige. Corporate identity—architecture as logo—had become a signature of twentieth-century architec-

True, Johnson's earlier IDS (Investors Diversified Services) building in Minneapolis, with its pleatedglass corners, skywalks, and atrium, had been a corporate showstopper. But Texas was a new frontier. Unconcerned with context or environment, the architecture emerged. An identifiable facade became

the prime selling tool of America.

And by serving the realtors and developers who replaced public planners as the shapers of the late twentieth-century landscape, Johnson became the architect of the kings of the marketplace. "They're the Medicis of today," he says. He chose to follow their orders: not to be a public advocate but to serve as courtier par excellence.

"I admire his originality, his willingness to take



OHNSON TOOK HIS FIRST STEP AWAY
FROM AUSTERE MODERNIST SHAPES WHEN
HE AND BURGEE DESIGNED PENNZOIL
PLACE IN HOUSTON. UNCONCERNED WITH
CONTEXT OR ENVIRONMENT, JOHNSON
DEVELOPED ARCHITECTURE IN TEXAS
THAT FOCUSED ON AN IDENTIFIABLE
FACADE. PENNZOIL PLACE WAS
COMPLETED IN 1976.

criticism, and to go back to the design board and start over," says Hines. "His ego isn't tied to [a given perspective]. It's a two-way street."

"His job . . . in Pennzoil Place is an outrageous classic in the extensive literature deriving from the flattery of patrons by artists," historian Vincent Scully maintains.

Johnson is an equally persuasive salesman with a mix of clients. Even the Reverend Robert H.

Schuller, the "Hour of Power" TV evangelist who hired the secular architect to build the soaring Crystal Cathedral in Garden Grove, Calif., thought Johnson and he were "on a very harmonious wavelength, and one that is transcendent enough to be labeled spiritual."

But wherever he works, Johnson is and always has been his own best publicist. He once told the Dallas Morning Herald that a 15-acre project he was to design for the area just north of Dallas would give the booming city a chance "to make a single artistic statement of its kind" unique in this century. "Frank Lloyd Wright never did it. Mies van der Rohe never did it. . . . We're making history."



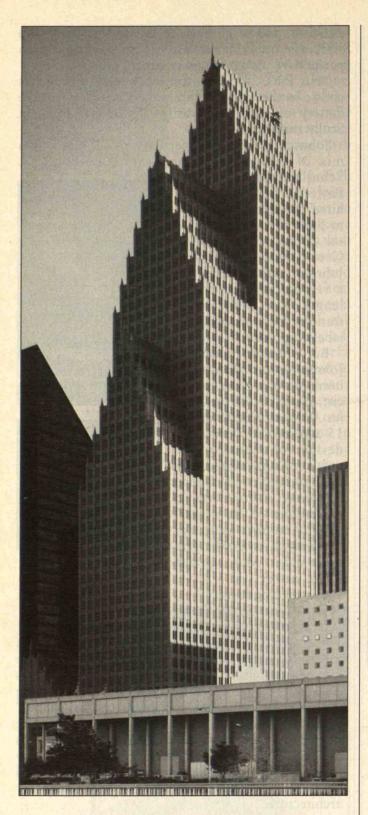


GARDEN GROVE COMMUNITY CHURCH (CRYSTAL CATHEDRAL), GARDEN GROVE, CALIF., 1980.

So it went in the Lone
Star state. But what exactly was the architect selling?
The question followed Johnson as the icons of Texas spread his name across the United States and won him the limelight commission for New York's AT&T building. Sure, Johnson was a convincing advocate for using "name" architects for "name" buildings. But was he more than a rainmaker putting a rainbow over the commercial waterfall that was dousing America? The question about how fancy facades affect urban design grew as he spread still another style from the cosmetic kit of contemporary architecture.

Ransacking Past Images

America was ready for a new style. Four decades after the founding fathers of modernism had thrown out the architectural encrustations of the ages, the box had become a bore. Using the straight-edged



ACROSS FROM PENNZOIL PLACE IN HOUSTON, THE JAGGED PEAKS OF REPUBLICBANK CENTER DEFINE ANOTHER ARCHITECTURAL STYLE: POSTMODERNISM. THE BUILDING WAS FINISHED IN 1984.

lines of industry to tool a better world for the masses mattered little, and less was no longer more. Philip Johnson, the restless formseeker, began to ransack the past for its abundance of images. In synch with the period's shift to historical styles, he began to combine classical columns, soaring arches, pedimented roofs, and extensive marble and granite, to advance the postmodern movement.

Standing on Houston's Main Street at the glassy Pennzoil, now more than a decade old, you can look across at this new generation of architecture—the red granite facade and jagged Gothic rooflines of the 780-foot RepublicBank Center, the latest Johnson/Hines building. Its interior modeled on the spacious ceremonial halls of past nobility, its exterior based on the seventeenth-century Guild House in Amster-

dam, this is postmodernism incarnate.

While the inside of Pennzoil's entrance is slick but confining, the lavishly adorned RepublicBank has a marble atrium that soars to banker's heaven. "Pennzoil to Republic is quite a change," Hines says dryly. Something may seem silly about cashing checks and watching tickertapes in this pseudo-palace. But the transformation between the two buildings is a striking summary of the sweep of architecture in the last decade and a testimony to Johnson's power to shape still another image for the builders of America.

In Dallas, Johnson's even more ornate concoction of offices and upscale shops known as The Crescent continues the theme of history on a super-scale. Built for the billionaire Hunt family, the mansard-roofed, candybox French chateau stands just outside the Southwest city. Joining 19 floors of offices and a 7-story hotel to a 3-story shopping emporium, the project is a glut of details: courtyards galore, iron trim everywhere, marble by the yard, The Crescent is historical display run amuck. "The world's largest use of limestone since the Roman Empire, the biggest hole ever dug in America . . . all that stuff," my Dallas architect/guide Stan Haas says disparagingly. "It's disgusting."

His is a strong but not unusual response. Many critics have failed to embrace the embellished facades of Johnson's postmodern designs. His plans for the block-long 500 Boylston Street building in Boston earned such local infamy that they were halved by the insurance-company developer. More painfully still, the erased half was handed over to disciple Robert A.M. Stern to redesign. Johnson's remaining plans resulted in an oversized building that—with an arch like a Philco radio and lifeless facade—towers over the historic Back Bay. Boston Globe editor Martin Nolan labeled the building the city's "first postmodern pimple . . . an outburst of the architect's second adolescence." Back Bay community groups argued that the project would deaden the environ-

ment of the entire street.

Recently, the story goes, master architect James Stirling asked Johnson, when in Houston, to visit Stirling's new building at Rice University. It is a handsome addition to a campus built over time, and the English architect was rightly proud that his creation made a personal statement yet accommodated its surroundings. Good fit had been a goal. "Did you like it?" Stirling asked Johnson on his return.

"I couldn't find it," was Johnson's retort. Safe to say, you can find Philip Johnson's buildings.

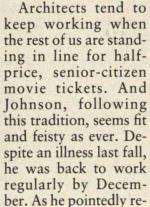
A Map of Johnson

For all of Philip Johnson's criticisms, it seems that the world he inhabits is a happy miniature of his long and active life. Looking out the window of his home in the Museum of Modern Art tower, the architect surveys his oeuvre and speaks of it with relish: the museum's sculpture garden below, Seagram's to the east, the top of the AT&T building above. He



THE CRESCENT, DALLAS, 1985.

has even appropriated his apartment's modernist interior—done by a competing architect—by planting a postmodern column in a glass-windowed corner.





500 BOYLSTON STREET, BOSTON. COMPLETION 1988.

minds friends and clients, his father died at 100. "I'm up against his genes," jokes his middle-aged biographer Franz Schulze, who has agreed to complete his work after the architect's death.

Conscious of his legacy, Johnson donated his Glass House to the National Trust for Historic Preservation last year. "There's that urge for immortality we all have," he says. Yet there is also the urge for provocation that made him criticize preservationists at the Trust's fall convention—and in yet another about-face, call himself a "card-carrying preservationist" a month later.

Immerse yourself in the statements and contra-

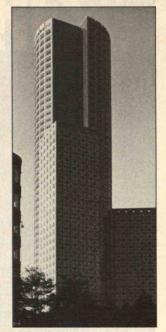
statements of Johnson's career, and you wonder. Who is the real Philip Johnson behind the careless, conflicting, ironic gestures? Does his lack of seriousness bespeak a dilettante as well as a provocateur? "I never really thought of Philip as an architect," Kevin Roche, an architect and admirer,

once declared. "With him, it's always seemed more like an avocation—like being a gentleman farmer. The rest of us are farmers, but Philip is a gentleman farmer."

As Johnson's former apprentice Michel Douglas asks, "If anything goes, does nothing matter?"

Does nothing of consequence matter? Modernism is replaced by postmodernism; postmodernism by deconstructivism—while the real issues of the built environment, from affordable housing to the destruction of the streetscape, are ignored.

Does Johnson care? On the evening of the opening of International Place, a



INTERNATIONAL PLACE, BOSTON. FIRST PHASE COMPLETED 1987.

million-square-foot postmodern Boston skyscraper that epitomizes this decade's inflated formalism and out-of-scale architecture, Johnson is in full form. "We're the kept people of power," he is saying once again—and once again his words are uttered with laconic majesty rather than anger. "We are only instruments of power."

"We live in an overly self-conscious, humorous, eclectic, split, directionless, religionless world. So our architecture shows that," Johnson said a decade ago. The statement holds today.

In this attitude, Philip Johnson, agent provocateur, servant of a private age—retains the dispassionate amorality of the curator. Propagandist for the modern movement—and assassin. Page-turner to the values of history—and corrupter of those traditions. He



is a symbol of our age. By endorsing the private "art" and practice of his architecture while refuting its public purpose, Philip Johnson may remain the dark mirror of not only his calling but our times.

Exceptional Experiences for Selective Travelers.

Ancient. Egypt Greece Asia Minor the Aegean Classical. Carthage Central Asia the Kyber Pass Mysterious. India Nepal the Himalayas Oriental. Japan Southeast Asia Java Enigmatic. Borneo Ceylon Sumatra Primitive. South America the Galapagos the Amazon **Ancient Civilizations** Vibrant. the Andes Australia New Zealand Compelling. **New Guinea** Kenya Tanzania Exciting. the Seychelles Northern Italy Burgundy Artistic. Southwest France Alsace-Lorraine the Rhine Cultural. the Moselle Flanders Scotland Wales Historic.

Highly acclaimed itineraries, especially designed for alumni of M.I.T., Harvard, Yale and other distinguished universities. For further information, please contact:



CONTINUED FROM PAGE 20



mary value. It is always derived from actions, principles, products, and human qualities that are desirable in their own right. A concert pianist who is about to enter a major international competition would be foolish to spend time agonizing over whether she is competitive. Her attention must be on the music she will play, the strength of her technique, her ability to reveal beauty and meaning in the score she has chosen. To do otherwise would jeopardize not only the intrinsic needs of her performance but the prize as well. In a similar way, those working to develop the next generation of technologies in microelectronics, manufacturing, and other fields would do well to focus on what truly matters: using their technical virtuosity to satisfy real human needs.

Are we headed toward a fundamental blunder? Frightened by what some believe are dark clouds on the horizon, Americans seem surprisingly willing to forget genuinely important goals and instead to pursue quack remedies heralded in business magazines. Let us hope sanity prevails before we go much farther. Economic competitiveness must be a by-product of ends, practices, and human relationships that we affirm for their own intrinsic worththat is, for the contributions they make to a more just and democratic society.

LETTERS

CONTINUED FROM PAGE 8

ANTARCTIC PARK

As a three-year veteran of the U.S. Antarctic Research Program, I concur with most of Barbara Mitchell's conclusions regarding the future of Antarctica ("Under-mining Antarctica," February/March 1988). Why do we assume that those who plan to develop resources there will protect the environment when their track record elsewhere is so bad? This is a crucial | Continued on page 80

question given Antarctica's remote location, which makes scrutiny by the press and concerned individuals difficult. Even though Mitchell implies that the proposal to make the region a world park is unrealistic, we should seriously consider it. Such an initiative would show that we have finally come to our senses about how we have been treating our own planet.

MARC LEVESQUE Portland, Me.

TRADE SECRECY

I would like to offer a word of caution to those inclined to take Eric von Hippel's advice and divulge proprietary information in pursuit of "cooperative R&D" ("Trading Trade Secrets," February/ March 1988). From a legal standpoint, most people in research and development do not have the authority to make these decisions without prior corporate approval. Moreover, enforcing trade-secret agreements is difficult and expensive. The complex problem of maintaining trade secrets should not be complicated further by the ad hoc decisions of researchers who may not understand the full ramifications of their actions-good intentions notwithstanding.

> ROBERT L. KELLY Detroit, Mich.

Robert L. Kelly is a partner in Cullen, Sloman, Cantor, Graner, Scott, and Rutherford, patent, trademark, and copyright lawvers.



"I HATE THE WAY THEY WRINKLE MY CLOTHES."

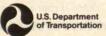


If you don't want to wear a safety belt, then suit yourself. But the fact is over 40,000 people injured in car accidents last year would give the shirt off their back for a second chance to buckle up. Stop making excuses and start buckling your safety belt.

YOU COULD LEARN A LOT FROM A DUMMY. BUCKLE YOUR SAFETY BELT.







Articles worth reading are worth reprinting.

THESE IMPORTANT ARTICLES FROM TECHNOLOGY REVIEW ARE NOW AVAILABLE IN REPRINT FORM:

"WHY WE NEED HANDS-ON ENGINEERING EDUCATION," by Arnold D. Kerr and R. Byron Pipes. October, 1987.	"GETTING OFF THE PESTICIDE TREADMILL," by Michael
	Dover. November/December, 1985.
"BURNING TRASH: HOW IT COULD WORK," by Allen	"OPTICAL FIBERS: WHERE LIGHT OUTPERFORMS
Hershkowitz. July, 1987.	ELECTRONS," by Les C. Gunderson and Donald B. Keck.
"CONSTRUCTION'S HIGH-TECHNOLOGY REVOLUTION,"	May/June, 1983.
by Fred Moavenzadeh. October, 1985	"CASTING FUSION ADRIFT," by Edwin E. Kintner. May/June,
"WOMEN IN TECHNOLOGY," by Lilli S. Horning.	1982.
November/December, 1984.	"THE NOT-SO-CLEAN BUSINESS OF MAKING CHIPS," by
"ELECTRIC HEAT: THE RIGHT PRICE AT THE RIGHT TIME	
by J.G. Asbury, R.F. Geise and O. Mueller. January, 1980.	
"THE JAPANESE LESSON IN QUALITY," by R.E. Cole. July,	Stern. January, 1984.
1981.	"MEMOIRS OF A BUBBLE BLOWER," by Bernard Zubrowski.
"WHERE THERE'S SMOKE, THERE'S IRE," by Linda Garmo	on. November/December, 1982.
April, 1984.	"WHAT TO DO ABOUT ACID RAIN," by Eville Gorham.
"KING CANUTE AND THE INFORMATION RESOURCE," by	October, 1982.
Harlan Cleveland, January, 1984.	"IS THE NUCLEAR INDUSTRY WORTH SAVING?," by Richard
"DIFFUSING TECHNICAL KNOWLEDGE: A NATIONAL IMPE	
TIVE," by George R. Heaton Jr. and J. Herbert Hollomon.	
October, 1983.	October, 1982.
"INVESTING IN ENERGY TRANSITION: FROM OIL TO WHA	(B) [B] [M] [M] [M] [M] [M] [M] [M] [M] [M] [M
by John Tirman. April, 1982.	Benbrook and Phyllis B. Moses. November/December, 1986.
"THESE DEEP WATERS DON'T RUN STILL," by Victoria Kah	
February/March, 1985.	Peter Gwynne. August/September, 1985.
"COMPUTER CRIME," by Leslie Ball. April, 1982.	"THE HOUSE THAT MACHINES BUILT," by Dr. Thomas
Good Crait Gallia, by Besite Ball. Hpm, 1762.	Nutt-Powell. November/December, 1985.
	IL ORDER USE THIS COUPON
······································	***************************************
YES! SEND THE REPRINTS I'VE CHECKED. (Reprints are \$2.50	each. Add \$1.00 for postage and handling. Canada/Foreign, add \$2.00 each)
TOTAL COPIES	NAME
TOTAL AMOUNT ENCLOSED \$	COMPANY
	THE STORY OF THE PARTY OF THE P
WRITE US FOR DISCOUNTS ON ORDERS OVER 100 COPIES	ADDRESS
and contract the state of the s	ZIP
RIPROVIS	
The Market	
OV BEVIEW	RETURN THIS FORM TO: "ATTENTION REPRINTS"
MOLOGI	TECHNOLOGY REVIEW

Industrial Crises; the Health of Nations

Coping with Disaster

Bhopal: Anatomy of a Crisis by Paul Shrivastava Ballinger, \$19.95

Reviewed by Larry Hirschhorn

According to a revealing graph near the beginning of this book, the number of people who have died from industrial accidents has steadily increased throughout the twentieth century. And of all the most serious accidents-those with fatalities of 50 or more—half have occurred since 1979. From this perspective, the industrial disaster at Bhopal, India, where dangerous MIC gas leaked from a Union Carbide chemical plant and killed 2,500 people, is no isolated incident. As industrial technologies become more complex, they may be outrunning our capacity to control

An associate professor of management at New York University and a native of Bhopal, Paul Shrivastava proposes a framework for analyzing and managing industrial crises. In Bhopal: Anatomy of a Crisis, his purpose is not to fix blame for that terrible accident but to devise mechanisms for avoiding others and coping with them when they do occur.

Shrivastava's search for solutions is understandable, and his detailed recommendations make this book a starting point for all future discussions of industrial disasters. But his point of view underestimates just how deeply rooted the tendency to crisis may be in our increasingly technological world.

Clashing World Views

In his detailed examination of the Bhopal accident and its aftermath, Shrivastava focuses less on technology or work design than on the behavior of three key stakeholders-industry, government, and the local community. Industrial crises occur, he argues, because such stakeholders are unable to coordinate their distinctive interests in a situation of increased interdependence.

Shrivastava shows how each group associated with the Union Carbide plant operated within an entirely different frame of reference. Corporate executives used a scientific and technical logic to assess the



causes and consequences of the accident. Committed to a world view in which objective information alone is used to assess the meaning of an event, they could appear willfully ignorant of the disaster's political and emotional aftermath—as if an appeal to rational argument could settle all disputes. "That is why," notes Shrivastava, "the corporation and its spokesmen sometimes seemed callous about the human suffering resulting from the accident.'

By contrast, the Indian government pursued a complicated political logic-on the one hand, representing its injured citizens in Bhopal; on the other, controlling and channeling their behavior. Company officers might be content to settle questions of blame by appealing to proven facts, but a government that hopes to reaffirm its legitimacy as the protector of the community must consider complex feelings about justice and the responsibility of the powerful toward the weak. And yet while officials were negotiating with Union Carbide, the Indian government was also disrupting planned demonstrations and arresting victims' rights activists in Bhopal, in an effort to make sure that no one could challenge its role.

Victims and their relatives and friends were less interested in the scientifically established links between causes and consequences and unsympathetic to the lengthy legalistic procedures for determining blame. They embraced a moral logic, believing that people who suffer damages have a right to immediate support, relief, and compensation. They had little patience with the political bargaining that normally ensues between companies and governments after an accident, and they were embittered by the stalemated conflicts between Union Carbide and the Indian government—as well as those among various government agencies. "What did Carbide do?" went a popular song in Bhopal. "It murdered thousands of people. What did the government do? It aided the murderers.'

Developing a New Social Framework

Shrivastava considers each of these frames of reference legitimate. The real problem, as he sees it, is their isolation from each other. To manage industrial crises, he argues, we must first acknowledge that such differences exist. Then we should develop a political and social framework that helps stakeholders broaden their frames of reference and cooperate despite their differences.

Developing countries are particularly vulnerable to industrial crises. They lack the social infrastructure required to manage technology-that is, the training, education, communications, and planning systems-but they are eager to set up and maintain industrial plants. Also, they frequently compete on the global market for plants and capital from multinational corporations, so they cannot regulate those corporations without risking the loss of capital, jobs, and income.

Nonetheless, Shrivastava believes that governments can establish balanced and sustainable development programs. They can assess technologies for their hazard potential, license new plants only after environmental reviews, balance capital-intensive technologies with more appropriate technologies, implement hazard-location policies, and ensure good roads, worker housing, and other aspects of an adequate industrial infrastructure.

Similarly, community organizations can educate themselves about the risks a particular technology poses. Shrivastava maintains that it is insufficient simply to inform communities of the dangers. In Bhopal, the people living around the Union Carbide plant were warned of potential hazards in a series of local newspaper articles, but "residents ignored these warnings because they did not know how to react to them, while local officials dis-

We are creating fragile technological environments but not the social systems necessary to sustain them.

missed them as sensationalist reporting." The alternative is to empower the local community by creating mechanisms that institutionalize grass-roots activism—for example "right-to-know" legislation which gives citizens the means to extract detailed and useful information from companies and governments.

In rich and poor countries alike, multinational corporations can develop corporate-wide codes to protect employees and the surrounding community. Shrivastava points to the minimum requirements for safety, worker health, and environmental protection that apply to Dow Chemical's 425 processing plants around the world.

Finally, Shrivastava contends that we need to develop new methods for resolving disputes and settling claims. For instance, we might replace traditional concepts of liability with a government-funded social insurance system. That way we could compensate victims of accidents prior to any consideration of who is to blame.

The Underlying Dynamics of Power

It is hard to argue with such recommendations. And yet I finished this book feeling uneasy. Shrivastava sketches an attractive vision of a self-regulating social bargaining process, in which the reasonable pursuit by different parties of their own interests leads to harmonious results. But he ignores the underlying dynamics of power. Put bluntly, why is it in the interest of more powerful stakeholders to cooperate with the weak? What countervailing power will make them do so?

Shrivastava's sensible desire to find solutions seems to lead him to assume that a new social world will emerge simply because he thinks it would be more rational. But he fails to consider another, more sobering possibility, the one illustrated by the graph at the beginning of his book: that breakdowns of complex technological systems-such as took place at Bhopal and, for that matter, in the Challenger disaster or at Chernobyl-will continue without any discernible improvement in the capacity of stakeholders to change. To cite just one example, the history of the U.S. nuclear power industry shows how entrenched interests can stave off change despite their sustained failure to reestablish their legitimacy and implement better management.

Evidence in Shrivastava's book supports

this alternate scenario. The Bhopal crisis was partly triggered by the paradoxical interplay of two crucial factors. On the one hand, the technical system of the plant had few margins for error. In Charles Perrow's terminology, it was a "tightly coupled" system, in which mistakes in any part quickly affect all the others.

On the other hand, the plant was also isolated from the broader corporate system. Corporate management in the United States, eager to sell the unprofitable Bhopal plant, had neglected it for years, so that the normal supports and resources that such a complex technical system needs were lacking. In particular, the number of workers assigned to manage the dangerous MIC unit fell by half from 1980 to 1984, and top management in India and the United States failed to fully implement the recommendations of a safety audit completed in 1982. This greatly increased the possibility of something going wrong.

The combination of tight coupling and social isolation may be characteristic of advanced technological societies. We live in an increasingly fragile technological environment but are unable—or unwilling—to create the social systems we need to

regulate and sustain it.

Examples of this paradoxical situation are not limited to chemical refineries or nuclear power plants. One important catalyst to the development of a violent urban underclass is that inner-city youths are isolated from mainstream social and economic institutions—even as they are tightly coupled to the mass media and its display of the symbols of wealth and status.

Recognizing this paradox helps explain why the multiple stakeholders in a potential crisis rarely cooperate to prevent it. People and communities with wealth and power find it easy to distance themselves from the consequences of complexity. They leave the dangerous technologies to underdeveloped areas or the cities to the poor.

The new technologies of telecommunications, electronics, and biology may be creating an increasingly integrated world, just as we are fragmenting the social system we need to coordinate and sustain our communities. If this is true, then bringing stakeholders together to negotiate the terms of their interaction and expand their frames of reference may be far more complicated than Shrivastava thinks. And his hope that a rational process of social bar-

gaining can regulate the new technologies may prove utopian. What Bhopal may really suggest is that managerial solutions are not adequate to the unique social crises of advanced technological societies.

LARRY HIRSCHHORN is a principal at the Wharton Center for Applied Research in Philadelphia. His new book, The Workplace Within: Psychodynamics of Organizational Life, was recently published by the M.I.T. Press.

The Power of Positive Thinking

The Health of Nations by Leonard A. Sagan Basic Books, \$19.95

Reviewed by George A. Silver

Few investigators can restrain the inclination to cry "Eureka!" when they believe they have discovered the answer to a longpuzzling question, and Leonard Sagan is no exception. In his case, the answer he seeks, and thinks he has found, is to the age-old question of how best to achieve and maintain good health. According to Sagan, the secret of health lies not in herbs and diet, not in immunizations and medical therapies, not in jogging and physical exercise, not even in technology or the social, economic, and political arrangements for medical care, but in the power of the human mind. As Sagan puts it, "the brain . is the true health provider."

This idea has its element of truth. After all, the medical profession and society as a whole have come to recognize the importance of mental and emotional factors in health and illness. However, Sagan champions his "cognitive" cure with such single-minded fervor that he ends up discounting other equally if not more important factors. And this ends up undermining whatever interest *The Health of Nations* might provoke.

A TV Program a Day . . .

Sagan uses data drawn from a variety of authors who have argued that good med-Continued on page 76 "The new Continental will change the way the world thinks of American cars."

—Car and Driver

"Under the Continental's sleek sheetmetal lurks a suspension engineer's dream come true: computer-controlled air springs and dual-damping shocks at each wheel."—Automobile

"...it's a magic-carpet limo that shifts to tied-down sports sedan exactly when you want or need it to. Amazing!" — Motor Trend

"This car translates much of the European standard of luxury into the American idiom. In so doing it redefines automotive luxury in the U.S. We think it will be a hit."—AutoWeek

The new Lincoln Continental. It's the world's most advanced luxury car. And that's not an opinion. It's a fact. For more information, call 1 800 822-9292.

LINCOLN What a luxury car should be

The Europeans would prefer we keep these opinions to ourselves.



LINCOLN-MERCURY DIVISION Find

Buckle up—together we can save lives.

CONTINENTAL

ical care is only one factor among many in improving health standards. This point of view has become commonplace: physicians and public-health workers have long accepted the fact that, just as few diseases can be reduced to a single cause, so too does good health rely on the complex interraction of genetic, social, and biomedical factors.

But Sagan goes to the opposite extreme, arguing that medicine is relatively unimportant to health. For example, he claims that the improvements in life expectancy during the past century are not due to the decline in infectious disease and improvement in nutrition made possible by better medical care and more comprehensive public-health strategies. What really matters, says Sagan, is new lifestyles founded on changes in individuals' thinking, which have improved people's "resistance." Environmental factors such as family unity, strong social networks, class mobility, and education—what Sagan calls "psychoso-



cial influences"—are important, because they contribute to a firm positive attitude

toward oneself and life and a rejection of the "hopelessness-helplessness" syndrome.

It's not that Sagan is unaware of or wholly rejects other contributing factors to good health. He just never seriously attempts to weigh their importance. For example, at one point he writes that there are "important genetic or inherited differences among individuals that influence their response to disease agents. . . . Throughout this book these differences will be ignored."

This perspective leads Sagan to embrace some superficially plausible but ultimately untenable positions. For example, in a long section on the role of stress in modern society, he makes the unexpected and interesting claim that stress, often condemned as a major contemporary cause of disease, may actually promote health rather than illness. Coping with difficulty is the natural road to healthy growth, Sagan argues; stress tests and therefore



The best that the area offers is accessible to Draper Laboratory, which is located in the Technology Square complex in Cambridge. It's all at your fingertips, whether you choose a short walk to the MIT or Harvard environs, a mass transit ride to downtown Boston, or an automobile trip to New England's mountains and charming sea coast.

It's all here.



Those of us who work at Draper Laboratory do so with pride because of our impressive record of accomplishments. Draper Laboratory is a leader in the research and development of Guidance, Navigation and Control, Fault-Tolerant Computing, Precision Pointing and Tracking, Advanced Spacecraft, Industrial Automation, and Undersea Vehicle Systems Design. Our unique "working laboratory" environment encourages freedom, creativity, and professional growth. If you are looking for a competitive salary, an outstanding benefits package including tuition reimbursement, and a state-of-the-art professional challenge, please talk with us.

If you have a Bachelor's degree or higher in EE, ME, Aero/Astro, CS, Physics or other technical fields, we'd like to talk to you. Please send your resume and salary history to Professional Employment, The Charles Stark Draper Laboratory, Inc., Dept. TR988, 555 Technology Square, Cambridge, MA 02139. We are an equal opportunity/affirmative action employer, M/F.

U.S. Citizenship is required.

The Charles Stark Draper Laboratory, Inc.

(617) 258-2885

When many lack vaccines and clean water, it is naive to celebrate the health benefits of the electronic media.

strengthens an individual's ability to cope. Thus, "rather than concern ourselves solely with the harmful effects of stressors, we should also concern ourselves with the coping skills of the weak so that they too can benefit from the challenges that we all need for healthy development." This makes sense as far as it goes. However, by ignoring complex social problems such as poverty, social class, and racism that can lead to poor coping skills in the first place, Sagan offers few practical recommendations for helping "weakly coping" individuals or families.

Sagan also believes that the same "cognitive" factors influencing an individual's response to pathogens are involved in the general health of a nation. "More important in explaining the decline in death worldwide," he writes, "is the rise of hope and the decline of despair and hopelessness. As important as the introduction of vaccines and clean water supplies may be the introduction of the transistor radio

and televison." Given that many newly liberated nations still cannot count on either widely available vaccines or clean water and have yet to achieve economic and agricultural self-sufficiency, to celebrate the health effects of the electronic media is dangerously naive and hardly convincing.

Science or Self-Help?

In the end, The Health of Nations is little more than another "self-help" book, cloaked in arcane professional garments and disguised as scientific discovery. Sometimes Sagan sounds more like a moralist than a scientist, as when he joins forces with spiritual and religious leaders in lamenting the decline of family values, which he considers the major reason for the "increasing ill health in the United States."

Sagan's recommendations—uncontroversial proposals like improving education

and strengthening the family-are not so much wrong as so general as to be useless. Even if he is right about the importance of good attitudes to health, what should be done in the meantime? And even if such attitudes spread throughout the world, a process that could take decades if not centuries, what about all those who, for whatever reason, continue to fall ill? It is likely that all the complicated traditional problems of health and illness-like inequitable, inadequate, and expensive medical care-will still be with us, even after the attitude changes urged by Sagan. Until such problems are addressed, Sagan's message lauding the benefits of improved mental and emotional health ought not to be tricked out in the pretentious garb of "the health of nations."

GEORGE A. SILVER, M.D., is emeritus professor of public health at the Yale University School of Medicine.



Technology Review's Bookshop by Mail Presents

A Fascinating Look at Mathematics MIND TOOLS Rudy Rucker

From mathematics and computers to insights into the workings of the human mind, *Mind Tools* is a reflection of the latest intelligence from the frontiers of mathematical thought. Illuminated by more than 100 drawings, *Mind Tools* connects mathematics to the world around us. Exploring such concepts as digital versus analog processes, logic as a computing tool, and communication as information transmission, Rudy Rucker presents the "mind tools" for a postmodern age.

"A lighthearted romp through contemporary mathematics. . . . It is shorter and more approachable than *Gödel, Escher, Bach.* *Mind Tools* is a delight."

— San Francisco Chronicle

paperback, 328 pages including index

Please send me cop	pies of Mind Tools at \$9.95, plus \$1.50 shippin
Check Enclosed For To	otal Ship Order To:
(Make checks payable to Technology Rev	view) and the same

OR EASY MAIL ORDER USE THIS COUPON

Technology Review's

OUR GUARANTEE: If for any reason you are not satisfied, return Mind Tools for a complete refund.

☐ Check Enclosed ForT	otal
Or (Make checks payable to Technology Re	view)
☐ Charge my: ☐ MasterCard ☐ VISA Card Number Expires	nid Tea

Supplies are limited, order by phone today, order numbers (charges only): (617) 253-8292 or (617) 253-8293

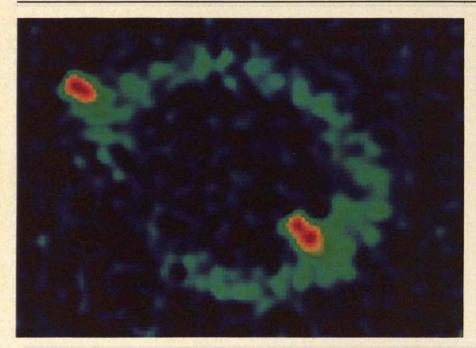
Ship Order	To:		
Name	ionale gener	Pall Prepa	lq offr ba
Address_	miked dare	micery dead	intellectories
C PODINGS IN	ibed die per		
City	State	ZIP	rulipelo

Mail to: Technology Review, Department MC, 201 Vassar Street, W59,

MIT, Cambridge, MA 02139

REPORTER

A DIGEST OF NEWS FROM M.I.T.



Unveiling a Second Genetic Control System

Elements of what is called a second DNA code were reported late in the spring at M.I.T. by Professor Paul Schimmel and Ya-Ming Hou, a post-doctoral fellow in Schimmel's biochemistry laboratory.

For 20 years scientists have been studying the code for assigning amino acids to the sequence of nucleotides that comprise the DNA molecule. But although they have believed a second code must exist for relating particular amino acids to particular forms of transfer RNA, they have not known what that code might be. Schimmel and Hou describe their finding as a "nucleotide pair," much smaller and simpler than they expected, that apparently determines the transfer RNA's identity.

It was in *Nature* magazine, where the Shimmel-Hou results were first reported, that Nobel laureate Christian de Duve used the phrase "a second genetic code" to suggest the significance of the work. Alexander Rich, Sedgwick Professor of Biology at M.I.T., described the new results as "the beginning of a big clarification [in molecular biology]."

Schimmel and Hou, who profess surprise at the wide public interest in their discovery, are unwilling even to speculate on practical applications. Just as a glass lens bends rays of light, so the gravity field of a star bends radio waves. Under some conditions, said Albert Einstein in 1936, radio waves from one star passing through the gravity field of another could appear as a luminous ring. Such gravity "lenses," forming two intense images from the energy of a single star, were first seen in 1979. And now the first "Einstein ring" has been reported (and displayed in this computer-generated image) by Jacqueline N. Hewitt of M.I.T.'s Haystack Observatory.

Hazards Under Wraps

Chemicals from plastic wrappings can migrate into foods. To prevent health hazards, the Food and Drug Administration regulates the plastics and plasticizers in wrappings for foods with oily, wet, or alcoholic surfaces. But because migration into dry foods has not been considered a problem, there is no regulation of wrappers for such products as milk powder, flour, and many breakfast cereals.

Now tests by Arthur D. Schwope of Arthur D. Little, Inc., and Robert C. Reid of M.I.T.'s Chemical Engineering Department show that migration also occurs into dry foods—and at rates comparable with those that have led to regulation in other types of foods. They urge further testing—leading probably to regulation.

Pluto: An Atmosphere

Two M.I.T. observers in NASA's highflying observatory 3,500 miles south of Hawaii watched as the planet Pluto eclipsed a small star for 80 seconds just after midnight on June 9.

Being in exactly the right place at exactly the right time to observe this phenomenon was "very difficult"—the words of Brian Marsden of the Harvard-Smithsonian Center for Astrophysics. Then why did the researchers bother? Because it was a first-ever chance to see what kind of a shadow Pluto casts.

The shadow is a fuzzy one, report James L. Elliot and Edward W. Dunham of the Department of Earth, Atmospheric, and Planetary Sciences. Which means that cold, tiny Pluto, at the far extremity of the solar system, has an atmosphere.

If present observations are correct, Pluto's temperature never exceeds -415° F. At that temperature, say Elliot and Dunham, a gaseous atmosphere would most likely be methane. Other possibilities: argon, carbon monoxide, neon, nitrogen, or oxygen.

The Growing Skill Gap

A significant mismatch between labor supply and demand is on the horizon for the United States, says Thomas A. Kochan, professor of industrial relations in M.I.T.'s School of Management.

The fastest-growing occupations in the last decade of the century will require more than a high-school education and higher-than-usual levels of language, reasoning, and math skills. But between now and the year 2000, more than 90 percent of the people who enter the labor force will come from groups, such as minorities and immigrants, that have not recently succeeded in penetrating these occupations, says Kochan in *Science*.

His conclusion is that there must be major increases in the skill levels new employees bring to their jobs in the next five years. Otherwise employers' needs will not be met, and equality of opportunity will not be achieved. That translates to major investments in affirmative action strategies, especially education and training. And how to make these investments most useful "should be a top priority for researchers and policymakers," writes Kochan.

PROFESSIONAL

INDUSTRIAL LIAISON OFFICER

MIT's Industrial Liaison Program seeks individuals to provide interface between MIT and assigned number of member firms of the Industrial Liaison Program. Responsibilities are effective liaison activities among MIT faculty, staff and representatives of member companies of the program. Plan and perform activities involved in servicing companies, including visits to company locations, group presentations, and meetings with company officials. Assist member company representatives with technical questions by arranging appropriate faculty contact or by providing relevant references and information. Arrange meetings on and off campus or telephone conversations with MIT faculty and staff for clients. Solicit new company members. Candidates must have intellectual depth, poise, present good appearance and be willing to travel.

Candidates must have Bachelor's and Master's degrees, with at least one degree in Engineering or Science; management perspective. Specific openings are available for individuals with degrees or equivalent experience in the fields of Electronics and Computer Science of Pharmaceuticals. One MIT degree preferred. Other required qualifications are a minimum of two years industrial experience, ability to communicate with technical staff and corporate executives, as well as MIT faculty and staff.

Interested candidates send two copies of both cover letter and resume referencing Job No. A88000 to: Ms. Cynthia Froeber, c/o MIT Personnel Office, 77 Massachusetts Avenue (E19-239), Cambridge, MA 02139.

MIT is a non-smoking environment. MIT is an affirmative action/equal opportunity employer.

29 years of technical placement

All Industries — Coast to Coast — Employer Paid BS, MS or PhD & post-grad. experience required in EE, ME, NE, IE, Met, CS, OR, CE, CHE, HP, IH, ES, Physics, Radiochemistry, I&C, DP, HWSW for design, manufacturing, sales, QA, test, systems. U.S. Citizens or permanent residents only.

(800) 523-2906; in PA (215) 735-4908 Arthur L. Krasnow, Pres. (MIT, USNA) Atomic Personnel, Inc. Suite T, 1518 Walnut St., Phila., PA 19102

VISITOR ACCOMMODATIONS



Looking for alternatives to expensive hotels?

We have rooms in Greater Boston, close to public transportation, for visiting professionals. Breakfast too!

Call (617) 738-1424 Host inquiries welcome.

PLACING PROFESSIONALS COAST TO COAST

We are constantly searching for:

•Engineers: EE's, ME's, CHE's

•Computer Professionals

•Aerospace Professionals

•Financial Specialists

Submit your resume and salary history to

Martin Lyons
TECHNICAL SEARCH GROUP

7 No. Main St., Suite 301, Attleboro, MA 02703 (617-226-5000)

The High-Tech People Client Companies Assume All Fees

You're Boxed In

Your career is blocked. You're frustrated and insecure. Time is going by and things aren't getting better.

You need to find a better way. You need new objectives for yourself and new strategies for achieving your objectives.

That's my job. I am a management consultant, specializing in change, and I have helped hundreds get out of that box and onto a more satisfying career and life path.

Call me to explore what I can do for you. There's no charge, no obligation, to explore. Don't wait. Call me now.



Management, MCP from MIT

weekend workshops. (see p. 8 for details.)

Riva Poor

73 Kirkland Street Cambridge, MA 02138 Telephone: (617) 868-4447

Private programs. Also 2-day

POSTDOCTORAL POSITIONS
IN

MOLECULAR BIOLOGY

Departments of Microbiology and Biochemistry University of Connecticut Health Center, Farmington, Connecticut.

Funded positions are available immediately to individuals with experience in molecular biology and/or protein biochemistry. The Health Center has developed vigorous programs of research aimed at understanding a wide variety of basic biological phenomena at the molecular level. Positions in the following laboratories are currently available:

Dr. Gordon G. Carmichael: Regulation of polyoma virus gene expression. Dr. Lawrence A. Klobutcher: DNA rearrangement in ciliated protozoa. Dr. Sandra K. Weller: Molecular genetics and biochemistry of herpes simplex virus DNA replication.

Applicants should supply a curriculum vitae and the names of three references to:

Dr. Sandra K. Weller Department of Microbiology University of Connecticut Health Center Farmington, Connecticut 06032

The University of Connecticut is an Equal Opportunity Employer.

OVERSEAS LICENSING, TRADE, & TAX HAVEN CONTACTS

Sell or buy patent and product licensing rights worldwide through

1988 World Trade Contacts Directory.

For free information on the Directory and on how to benefit from tax havens, write to:

> Asset Haven Association, Ltd., Island Resources National House, Santon, Isle of Man, British Isles

PATENT TRADEMARK & COPYRIGHT LAW

Searches, Applications, & Litigation

J.P. Violette

Reg. Patent Attorney S.M. MIT ENGINEERING Adj. Prof. Elec. & Mech. Eng'g

1-800-825-LAWS

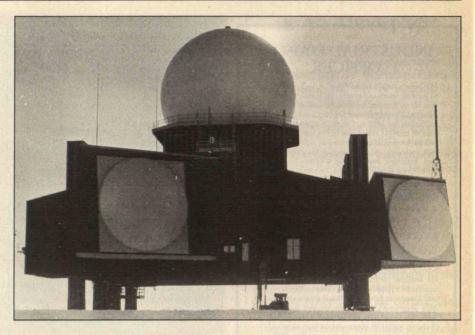
ARCTIC ARCHITECTURE

"Was Newton Wrong?" by David Graham (February/March 1988) features a picture of scientists on the Greenland icecap with a strange building in the background. I'd like to explain what the building is.

There are only two buildings like that, and they are both part of the Distant Early Warning System (the DEW line). I spent a year at one and have included a closer picture of it (right). It stands about 30 feet above the surface so snow can blow through. If snow builds up, the structure can be elevated to keep the clearance.

The dome on top houses a radar antenna, and the two small ones contain communications antennae. About 30 people live inside for months at a time, occupying four floors with a small fifth floor below the radar antenna.

RICHARD GREENLEE Davenport, Iowa



3-D paper skeleton with • Fully articulated joints • A separate full color photographic poster illustrating the wonders of the skeletal system (20" x 27") Only 20 pieces to assemble (imprinted with all 206 bones) Complete step-by-step instructions, with enlarged

details • A large illustrated

make-it-vourself.

two-thirds lifesize



physician-written pamphlet, "All About Bone."

It's a terrific educational gift for curious boys and ghouls of all ages - and a fun project for Halloween parties or decorating!

Produced in England, BARE BONES comes carefully packaged in sturdy, heavyweight plastic, ideal for safe shipping.

A FACTS ON FILE SELECTION.

ALL YOU NEED ARE SCISSORS AND GLUE TO BUILD THIS ETERNALLY FASCINATING, SCIENTIFICALLY ACCURATE SKELETON



IF FOR ANY REASON YOU ARE NOT SATISFIED. RETURN BARE BONES FOR A COMPLETE REFUND

-	FOR EASY MAIL ORDER USE THIS COUPON — — — —
2_	copies of BARE BONES at \$14.50 each

I want to bone up! Send me Check enclosed for _ TOTAL (make checks payable to Technology Review)

☐ Charge my: ☐ MasterCard ☐ VISA

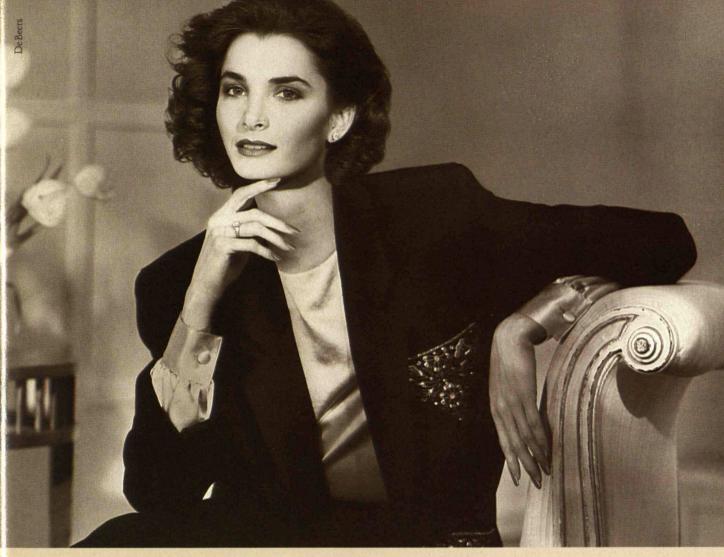
Card number _ Expires Signature.

> SUPPLIES ARE LIMITED! SAVE TIME AND ORDER BY PHONE TODAY! ORDER NUMBER: (617) 253-8293 (CHARGES ONLY)

CITY	STATE	ZIP	THE REAL PROPERTY.
NAMEADDRESS	CONTRACTOR OF THE PROPERTY OF		
Ship order to:			
ust \$12.95 plus \$1.5	o for shipping)		

We can ship to different addresses - just enclose a separate sheet of names and addresses.

MAIL TO: TECHNOLOGY REVIEW, DEPT. HS, 201 VASSAR ST., MIT, CAMBRIDGE MA 02139



SOME THINGS IN LIFE ARE SO SUPERB ONE IS COMPELLED TO BRING THEM TOGETHER.

Some men have the ability not only to embrace beauty, but to revel in it. They joyfully acknowledge that there is a particular pleasure in giving something rare and lovely. The rarest and loveliest object of all being a fine quality diamond of a carat or more.

Your jeweler is the expert. He can show you many pieces of quality diamond jewelry such as this classic 3 stone ring with a magnificent brilliant-shaped centerstone of 3.59 carats. Or another that will reflect your own taste and style. And tells the world

that you delight in that which is truly and eternally beautiful.

For more information and a complimentary booklet, "Diamonds of a Carat or More," write to: Diamond Information Center, 1345 Avenue of the Americas, New York, N.Y. 10105.

A diamond is forever.



DIAMONDS AS EXCEPTIONAL AS THE WOMAN WHO WEARS THEM.

"The food was delicious and the service excellent."

Rose Dannenfelser Great Neck, NY

"I had one of the finest flying experiences of my travels. Checking in for the flight was a delight. Your reservations personnel were friendly, as were your ticket agents. Your flight attendants were superb."

> Richard D'Amelio San Francisco, CA

"We were treated like royalty. We never expected free drinks, a beautiful meal, free movies...we honestly felt we were in First Class instead of Economy."

Felicia & John Petosa Massapequa Park, NY

"My business requires frequent international travel, and my recent experience with British Airways would suggest you are now in the forefront of quality service.

"On these flights your departure times were dead on and the cabin service was superlative—my compliments to your flight and cabin personnel."

> T.W. Roarke Tacoma, WA

"Captain and crew were simply magnificent. Please convey my sincere thanks to all the British Airways people involved with our flight. They are the very best at what they do."

> James R. Folts Blairstown, NJ

"We were treated with the utmost care, even though we flew Economy Class. Everyone was so kind and thoughtful. There cannot be enough said of your personnel and the gracious and polite way we were treated."

Mr. & Mrs. Fred F. Larimer Long Beach, CA

"I have traveled many times, and on many different airlines, but I wanted you to know that I find British Airways to be the very best by far."

Carol Lehigh Burbank, CA

THE CUSTOMERS ALWAYS WRITE.

